The Lesser-Known Phenomenon of Sports: A Systematic Review of Runners' High

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ABSTRACT

The current review aims to provide a synthesis of available research into runner's high and an investigation of its physiological and psychological bases. Because runner's high is characterized by alterations in euphoria, a decrease in anxiety by sedation, and analgesia, the research relates it to the release of endorphins and endocannabinoids. The present critical review scrutinizes previous research methodology, mentioning the strengths as well as weaknesses, and focuses mainly on the application of standardized methods to enhance comparability between results. The evidence mapping indicates the core concepts, terminologies, and ways in which runner's high could be complex, contributed by individual physical fitness, mental state, and genetic predisposition. The knowledge gaps identified from this study are in terms of consistency, form, and intensity of runner's high across various groups and exercise situations. Methodological insights point toward the use of multiple methods complemented by neuroimaging techniques with qualitative assessment to understand this complex phenomenon. Implications include focused therapies designed to enhance the mental health benefit from exercise and refining athletic techniques in training. This review suggests that, in the future, in-depth research shall be done on the variances in the runner's high to lay a base for theoretical advances with consequent practical applications in sports science and psychology. Ends: This synthesis provides a roadmap to improve knowledge and maximize benefits of runner's high.

Keywords: *Runner's high, Comprehensive review, Endorphins, Endocannabinoids, Exercise physiology, Psychological benefits*

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Introduction

A runner's high is a euphoric sense felt after or following extended cardiovascular exercise, particularly running (Siebers *et al.,* 2023). This condition is distinguished by reduced worry, a greater sense of well-being, and a reduction in perception of pain. It is mostly due to the production of endorphins and endocannabinoids, which work as bodily pain relievers and mood boosters. Psychologically, a runner's high promotes positive behavior, increasing motivation and commitment to exercise. In athletics, it improves efficiency through decreased perceived exertion and pain, which aids endurance (Menheere *et al.,* 2020). Knowing runners high is important for psychology and athletics because it emphasizes the psychological and physical advantages of exercise, hence boosting overall wellness including mental well-being. These phenomena underline the comprehensive influence that exercise has on not only physical health but also on mental toughness and mental health (Oswald *et al.,* 2020).

Thus, one needs to examine this phenomenon of runner's high more closely to understand the physiological and psychological origins. Physiologically, the phenomenon involves complex interactions among neurotransmitters that include endorphins and endocannabinoids, which are poured out in large amounts during prolonged cardiovascular exercise (Matei *et al.,* 2023). These are molecules associated with the alleviation of pain and the improvement of mood; however, exact activity pathways and links between them remain to be investigated. Again, it is learning these procedures that shall expose how routine exercise benefits

both our physical health and our mental health (Buecker *et al.,* 2021). Such a comprehensive review should be aimed at collecting all the knowledge available on runner's high and making a complete understanding of its physiological and psychological basis in front of the readers. The primary goals of the research include: To identify and map available evidence; To report on the types of evidence that address and inform practice in the field and the way the research has been conducted; To identify the types of available evidence in the field; To clarify key concepts/ definitions in the literature; To examine how research is conducted on this topic; To identify key characteristics or factors related to this concept; To identify and analyze knowledge gaps.

Method: The method for the complete review of Runner's High includes doing a systematic literature search for research on neurological, psychological, and physiological components. The included papers will be evaluated critically for synthesis of evidence, rigorous methodology, and the recognition of research gaps. Methodological insights will concentrate on study design, measuring methods, and data analysis procedures to guarantee an exhaustive examination of the phenomenon.

Inclusion criteria- The inclusion criteria for this study include published papers with the full text accessibility in English that investigate the phenomena of runner's high. Given the scarcity and diversity of the literature on this subject, the criteria are purposefully broad to cover a wide variety of results. Human-participant studies with qualitative, quantitative, or mixed-method approaches are particularly taken into account. There are no limitations based on publication date, demographic characteristics (such as age, gender, or location), or specific methodology. This method seeks to gain complete insights into the neurological, psychological, and physiological components of runner's high, as well as to investigate the various factors that influence its occurrence, intensity, and duration across groups and contexts.

Exclusion criteria- This review excluded articles that had not been published or did not have the full text availability. Studies that are primarily concerned with pharmaceutical interventions related to the occurrence by nature of runner's high after exercise will not fit the criteria. Furthermore, research that investigate immediate physical effects unrelated to the psychological, neurological, or physiological components of the runner's high will be eliminated. These criteria are intended to guarantee that only pertinent and robust research adding to our understanding of runner's high is synthesized.

Search strategy- Google Scholar is one of several databases. The searched keywords included "runner's high". The use of this string suggests a thorough search procedure meant to assemble relevant literature bases on the runner's high, with an emphasis on Evidence Synthesis, Methodological Insights, and Research Gaps. A diverse collection of scholarly publications and articles is compiled utilizing several databases.

Data analysis- To validate the runner's high, a systematic literature review was conducted utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) technique

Table 1: Quality analysis of data

Data quality	Excellent	Good	Satisfactory	Inadequate
Methodology quality	Perfect research design with more data and the best results	A coherent study design with a reasonable result.	A vague study design yields sensible results.	Contains numerous faults.
Methodology relevance	The methodology suits the issue without any variation and offers a precise output.	The research question was revealed, and it matched the outcome.	The study topic is unclear, yet it matches the research design and conclusion.	Inappropriate relevance.
Topic relevance	The study fully aligns with the issue, offering solid support for future studies.	Stays consistent with one review and provides meaningful results.	Certain parts of the study match the theme.	Not related to the issue.

PRISMA Flow chart

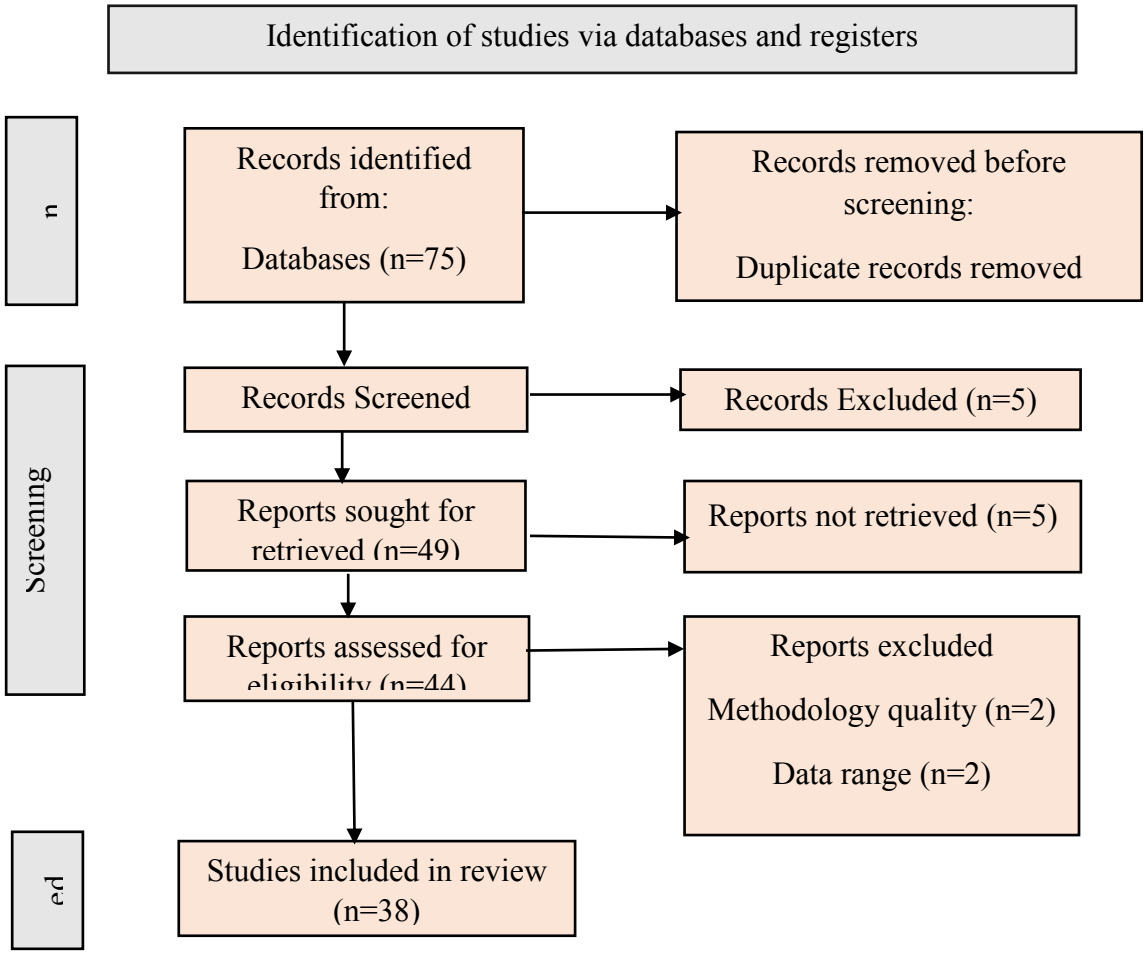

Figure 1: PRISMA summary for the study undertaken through 2024.

Synthesis of Existing Evidence

Studies on runner's high use a variety of evidence, including experimental and observational methodologies, each of which contributes unique insights into the phenomena. Experiments show that prolonged, intense exercise increases endorphins and endocannabinoids, neurotransmitters associated with pain relief and euphoria, indicating a strong link between exercise and psychological well-being and establishing causal relationships between running variables Initial findings from both kinds of studies show that a runner's high does not depend only on physiological responses but also on many psychological factors: mood, personality traits, and the meditative features of running. Longitudinal studies in this case trace changes across time, showing how the state of a runner's high is changing with training and particular aspects of lifestyle. They underline that regular exercise has long-term mental health and well-being benefits. Overall, these numerous techniques and findings add to a more detailed understanding of the runner's high, underlining its multimodal character and intricate interplay between physical activity, neurobiological processes, and psychic states.

The experimental investigation by Boecker et al., (2008) evaluated the opioidergic mechanisms underlying runner's high and related it to subjective feelings of euphoria. In this study, ten athletes were scanned before and after running, which revealed lower opioid receptor availability in the prefrontal and limbic/paralimbic brain areas within the period following exercise. This supports the opioid theory, which the runner's high is mainly dependent on brain areas connected with mood regulation. The study by Raichlen *et al.* (2012) discovered that mammals are motivated to engage

in high-intensity exercise activities by endocannabinoids, or eCBs. This implies that eCB signaling, particularly in species acclimated to high-intensity locomotor movements, may represent a neurobiological mechanism promoting habitual aerobic exercise.

The observational study by Masters, (1992) examined the hypnotic susceptibility of marathon runners, the cognitive detachment they experience while running, and the runner's high they encounter. Researchers evaluated hypnotic susceptibility scores, dissociation tactics used during marathons, and subjective accounts of runner's high through surveys and interviews using observational methods. The results showed that greater training scores and more usage of dissociation as a running strategy were connected with higher hypnotic susceptibility. Runner's high is usually induced by long-distance running, a form of prolonged moderate-to-intense cardiovascular exercise. A runner's high can last from several minutes to many hours after exercise; it may even last longer. The intensity also differs from one individual to another; some described a slight feeling of relaxation, and others said they experience extreme exhilaration. Dopamine, endocannabinoids, and endorphins are the main neurobiological factors that interact to influence mood and perception of exertion. Overall, these data point to the fact that the runner's high is a complex phenomenon influenced by both individual-psychological states and biological processes.

Buist *et al.,* (2010) found predictive variables for running-related injuries (RRIs) in rookie male and female runners. 532 participants (226 men and 306 women) preparing for a 4-mile event were enrolled by the researchers. In addition to an orthopedic examination and 13 weeks of monitoring, participants completed a baseline questionnaire. Running restrictions lasting at least one week resulting from musculoskeletal pain in the lower extremities or back were classified as RRIs. The findings indicated that men's higher BMI, past injuries, and past involvement in sports without axial stress were important predictors. The only meaningful predictor for women was navicular decrease. The study shows that male and female rookie runners have different risk profiles. (Yagi *et al.,* 2013) determined the prevalence and contributing variables of tibial stress fractures (SF) and medial tibial stress syndrome (MTSS) in high school runners. Over three years, 230 runners who were 15 years old were assessed. Height, weight, BMI, Q-angle, navicular drop test, hip abductor strength, hip and ankle motion range, and physical conditioning were all measured. The findings revealed 21 SF cases and 102 MTSS cases. The significant risk variables for MTSS in females included increased hip internal rotation and higher BMI. Moreover, the chance of SF in males was markedly elevated by limited SLR. The study emphasized the risk variables of gender for SF and MTSS.

Weighing the pros and cons of research into runner's high, several important methodological insights become apparent. First, one of the strengths is that it applied very advanced neuroimaging techniques, like fMRI and PET. These techniques make it possible to investigate changes in brain chemistry and activity. Moreover, physiological recordings and questionnaires may provide accurate such details with respect to subjective experiences and bodily reactions. However, there are a few limitations. The simplest potential source of bias or measurement error comes from self-report data. Comparative comparisons are made more difficult by inconsistent definitions and standards for runner's high. Moreover, longitudinal studies are less common and require a lot of resources, whereas cross-sectional designs restrict the capacity to infer causal correlations.

Psychological and Physiological Mechanisms: Both physiological and psychological factors are involved in this phenomenon. The primary physiological cause of runner's high is thought to be the production of endorphins, which are neurotransmitters that have anti-depressant and pain-relieving properties. The brain produces more endorphins after prolonged physical exercise to help it deal with the stress and agony of effort. Furthermore, new studies emphasize the function of endocannabinoids, including anandamide, which can improve mood and contribute to sensations of euphoria and wellbeing by crossing the blood-brain barrier. Running's

meditative qualities can lead to a state of flow, or a mental state where one is totally absorbed and involved in the activity, which can reduce anxiety and promote calmness. This has a psychological effect on runner's high. Running is rhythmic in nature and involves the repetition of motion, which can bring about a relaxation response, reducing stress levels and improving mood. These mechanisms and systems combined have a powerful effect to improve mood, reduce pain during and after running, and thus contribute to addictive properties for regular exercise like running.

A study by Sin et al. (2015) examined the relationship between performance, stress levels, and personal psychological capital among marathon runners. Their findings showed a significant positive relationship between the high perception of stress levels and marathon running performance, while personal psychological variables like optimism and self-efficacy have negative relations with stress. This suggests that mental toughness and optimism can have a significant impact on runners' ability to cope with stress, hence improve performance, and even alter their runner's high. In a recent study, Geisler et al. (2020) examined the effect of a two-hour run on mood and pain perception in non-elite male runners, using fMRI and pinprick stimulation. A visible increase in feelings of euphoria or decrease in pain perception was not indicated; however, there was lower limb pain, and the study did suggest an improved mood following the run. These data indicate that although endurance training can improve mood state, fewer incidents of runners high and hypoalgesia are observed among non-elite runners. These results collectively underline that runner's high is an interaction of both psychological factors like stress tolerance and pain tolerance, and physiological alterations in terms of increased blood flow and elevation of mood.

Exploration of psychological factors contributing to Runner's high: Psychological factors contribute to most of the runner's ecstatic experience. This pleasant change in attitude may further contribute to the intensification of runner's high. Personality factors also contaminate the possibility of experiencing runner's high. For instance, people high in extraversion and openness to experience might be better prepared to appreciate and more readily seek out both the positive effects of long-distance running and the difficulties that go with it. Such characteristics are likely to raise the chances of entering flow states, which are especially pleasant and highly involved. It could therefore also be that higher levels of self-motivation and resilience enable a person to master the temporary discomfort of running until a runner's high is more readily experienced.

In the study by Titze et al. (2005), certain factors that influenced the adoption and maintenance of regular leisure-time running among mid-aged women were mentioned. The results have shown that high enjoyment from running, together with the frequent application of behavioral modification techniques, increases the opportunity for regular running. It is also established that insufficient motivation, low self-esteem, and an unattractive neighborhood contributed most to increased regression from regular running. In the study, Waśkiewicz et al. (2019) set out to compare the motives of achieved marathon runners with those of beginner runners. The participants were 1,537 runners; out of these, 75.3% were men, while 24.7% were women. Their results indicated that successful marathon runners have no significantly different motives compared to the control group. However, female marathon finishers reported less competitive motivation than men and high scores on these issues: weight concern, affiliation, psychological coping, life significance, and self-esteem. Besides, the questionnaire revealed that age, education, and training features were associated with motivation. Anyway, the findings validated age and gender as significant predictors of the motives of both males and females who finished a marathon and controls.

Mood States: High emotional states, like euphoria, reduced anxiety, and feelings of increased well-being, characterize the so-called runners' high of athletes at the top level of performance. These alterations in mood are assumed to be mediated by the release of endorphins, endocannabinoids, and other neurotransmitters that occur during long periods

of aerobic exercise. From psychological theories, it is possible to deduce that the chance and degree of runner's high experienced could be affected by differences in personality, coping strategies, and cognitive processes on the part of a runner. This, in turn, favours complex interplay between physiological responses and psychological experiences. However, the main challenge that persists is one of reliable measurement of subjective experiences and individual variability in their sensitivity to the duration and intensity of exercise.

A study by Howe et al. (2019) investigated the impact of trait emotional intelligence on mood states and serum cortisol responses to an 80.5 km treadmill ultramarathon. The ultramarathon was completed by twelve subjects on a motorized treadmill following the measurement of their trait El before the trial. Their result showed that alterations in the stress response to these exercises in endurance depend on the mood states and emotional intelligence.

Chan & Grossman, (1988) explain a study that assessed the psychological effects of running cessation in regular runners. The sample used consisted of thirty runners who could not run for a minimum of two weeks that were compared with thirty runners who were able to run continuously. According to the results, compared with the continuous runners, the interrupted runners reported significantly more symptoms of psychological malfunctioning, like depression, anxiety, confusion, general mood disturbance, and low self-esteem. According to these researchers, the informed hypothesis in this study was that regular runners who rely upon running as a coping mechanism for stress relief, and who feel reliant upon the psychological benefits accruing from running, may experience symptoms of withdrawal psychological distress upon cessation of running.

Personality Traits: Waleriańczyk & Stolarski, (2021) examined the findings of the two separate investigations on how perfectionism affects distance running performance. Excessive striving for perfection was found to be a strong predictor of run results, accounting for an extra 7% and 13% of variance beyond age and gender. The relationship between expected and actual performance was similarly influenced by perfectionistic strivings, and the effects persisted even after adjusting for Big Five personality traits. This offers groundbreaking proof that aiming for perfection has a major positive impact on sports performance, namely in distance running. Merritt & Tharp, (2013) examined a study that sought to comprehend how parkour and free-running practitioners' personalities, levels of self-efficacy, and willingness to take risks relate to one another. A survey on personality traits, self-efficacy, and perceived risk-taking was completed by 277 participants in the study. The findings indicated a correlation between high neuroticism and poor conscientiousness and more careless risk-taking behaviors. The link between neuroticism, conscientiousness, and risk-taking was revealed to be significantly mediated by self-efficacy. The study found that in parkour and free-running practitioners, self-efficacy is critical to understanding the motivations underlying dangerous sports practices.

Sato *et al.,* (2018) explains a study that looked at the connection between life satisfaction, running involvement, and personality factors. It implies that engaging in physically demanding hobbies like jogging is associated with greater life satisfaction. The big five personality qualities and their effects on running involvement and life satisfaction are the specific subjects of the study. The findings demonstrate the beneficial indirect impacts of conscientiousness and openness to new experiences on life satisfaction through self-expression, centrality, and attractiveness.

Examination of Physiological Mechanisms: A complex interaction of neurobiological processes produced by aerobic activity is revealed when the physiological reasons behind runner's high are examined. Monoamines including dopamine, endocannabinoids, and endorphins are important mediators of the euphoric condition known as "runner's high." Endorphins bind to opioid receptors in the brain during exercise to reduce pain perception and promote emotions of well-being. They are released from the pituitary gland and hypothalamus. Endocannabinoids alter mood and reward systems by activating cannabinoid receptors in the brain, just like the cannabinoids in cannabis. Exercise also releases dopamine, a

neurotransmitter linked to motivation and pleasure, which adds to the positive feedback loops created by physical activity. Physiological studies using techniques such as fMRI and PET identified specific brain regions implicated in these processes, in particular, prefrontal cortex, limbic system, and basal ganglia—nerve centers crucial in pain modulation, reward processing, and mood control. That being said, the individual variability and temporal dynamics in neurochemical responses to exercise still elude complete comprehension.

Fletcher & Monte-Colombo, (2010) examined the physiological processes behind the alterations in performance brought on by various pre-activity stretch techniques. Three warm-up conditions were executed by twenty-one male collegiate-semi-professional soccer players: no-stretch, static passive stretches, and static dynamic stretches. Peak torque and jump tests demonstrated a considerable boost in performance with static dynamic stretching. The rectus femoris muscle showed more activity during the static dynamic stretches, as evidenced by physiological data that showed elevated heart rate and core temperature. These results imply that the enhanced performance with static dynamic stretches is most likely due to higher heart rate, peak torque, and muscle activation.

Endorphin Release: One of the key physiological mechanisms underlying the phenomena of runner's high is endorphin release. Reaction to aerobic activity, the functions of the class of neurotransmitters and peptides which are mostly synthesized in the pituitary and brain, include endogenous analgesics and mood enhancers. Endorphin generation and release are raised by prolonged and high-intensity physical activity like long-distance running. These endorphins then bind to opioid receptors in the brain and spinal cord, reducing the perception of pain and enhancing pleasure and wellbeing. It has been proven that duration and intensity of exercise are major factors in releasing endorphins. It has been revealed in studies that endorphins significantly increase during or immediately after exercise, consistent with reports of "runner's high.". One of the well-explained points brought out by Siebers et al. (2021) is the phenomenon referred to as "runner's high." Following a session of long-distance running, most people experience improved well-being and a reduced level of anxiety. The theory of endorphin-induced sensation is proved null and void by the fact that the studies resume that opioid transmission is not necessary to create runner's high in either humans or mice. Rather, research has been carried out to link endocannabinoids with exercise-related euphoria and anxiety reduction.

A study by Doyernart et al. (2020) highlighted the psychophysiological changes that amateur runners have undergone after finishing a half marathon. The physical and psychic changes included a reduction in the lumbar strength, heart rate, caloric expenditure, muscular discomfort, perception of effort, self-esteem, and happiness. Effectively, the research is found on the fact that half-marathon preparation may influence different aspects of a runner: both physiologically and psychologically, finally increasing well-being and increasing happiness. Hamedinia et al., (2017), examined changes in the endocannabinoid system, serotonin, beta-endorphin, and brain-derived neurotrophic factor in young males after an eight-week period of aerobic, anaerobic, and resistance exercise. In this study, 32 participants were assigned to a control group and different exercise groups. The results indicated that both aerobic and anaerobic exercise increased the levels of BDNF. However, aerobic exercise training significantly increased the levels of serotonin. However, the activities did not alter specific levels of beta-endorphin and endocannabinoids. The levels of happiness significantly increased in the three training groups compared to the control group. Conclusively, the research held that long-term exercise may have effects on human pleasure and happiness, although further research has to be conducted to determine the exact effects on the endocannabinoid system.

Neurobiological Pathways: Neurobiological routes in producing the runner's high entail quite a complex interplay between mood regulation and reward processing paths, together with their respective neurotransmitters and brain areas. Prominent contributors to these pathways are endocannabinoids anandamide and 2-

arachidonoylglycerol, and their stimulation of brain cannabinoid receptors controls mood and perception of pain on the background of hard aerobic exercise and subsequent to it. Part of this runner's high and other stress-relieving and euphoric effects can be accounted for by some of these endocannabinoids, whose actions are similar to cannabis chemicals. Monoamines, including serotonin and dopamine, are another group engaged in the neurochemical reaction to exercise. The rewarding elements of physical activity are reinforced through an increased release within the reward system of the brain of the neurotransmitter dopamine, increasing motivation and positive reinforcement. Known for its role in regulating mood, serotonin is most likely also involved in the general feeling of well-being and relaxation in the aftermath of exercise. Neuroimaging studies using techniques including fMRI and PET point to an implication of the prefrontal cortex, limbic system, and basal ganglia. Basically, these regions are involved in the processing of sensory information, the regulation of emotional responses, and the modulation of pain perception. Thus, each function points to some of the complex neurophysiological mechanisms underlying runner's high. Moderate-intensity continuous exercise and high-intensity interval exercise on biochemical markers and cognition in boxing athletes: a randomized controlled trial was studied by Buzdagli et al. (2024), assessed the effects of moderate-intensity continuous exercise and high-intensity interval exercise on biochemical markers and cognitive function in boxing athletes. The findings demonstrated that immediately after exercise, HIIE induced significantly greater elevations in neuroprotective biomarkers, BDNF, S100B, and NSE, compared to the MICE and controls. Both HIIE and MICE improved CF, but HIIE performed better in terms of reaction time and error count in the neurocognitive tests. The study suggested that HIIE had greater benefits for athletes related to neuroprotection and cognitive function, mainly when sports required a high degree of cognitive skills.

Applications in Sports and Health: The runner's high phenomenon in itself is of great significance for both sports and medicine and has relevance to the understanding of both physical performance and general health. By targeted training for an enhanced experience of long-distance running, athletes enhance their performance with better control over the phenomenon of a runner's high. Tactics that promote the release of endorphins and endocannabinoids associated with the runner's high may be applied by coaches and trainers in a way to improve mood, decrease the perception of pain, and increase endurance. This is also a good motivation strategy for implementing regular physical activities among healthy people. Frequently performed cardiovascular exercise, like jogging, primarily enhances mental well-being, reduces stress, and attenuates a bad mood, thereby proving to be an effective therapy against diseases of anxiety and depression. It is believed that the analgesic effect created by Runner's High promotes a course for the non-pharmacological and natural management of chronic disorders of pain and improves general health.

Janssen *et al.,* (2020) investigates the beliefs, passions, and attitudes of various running types toward the gadgets they use—like sports watches and smartphone apps. Four different sorts of runners were found using data from the 2016 Eindhoven Running Survey: social competitive, individual competitive, casual individual, and dedicated runners. According to the survey, different sorts of runners employ various kinds of technology. Health experts, legislators, engineers, and trainers can use this information to better target their services at particular runner demographics and encourage an active and healthy lifestyle. Both recreational and competitive runners can benefit greatly from research on runner's high. Understanding runner's high can be a significant incentive for recreational runners to participate in regular physical activity. These effects are also linked to runner's high. Runner's high study can contribute to the promotion of a healthier and more active population by highlighting these advantages.

Research Gaps and Future Directions: Despite tremendous progress, several gaps remain in this research on runner's high. First and foremost, there is a need for further study regarding the specifics of neurochemical processes. While much work has identified endorphins and looked at endocannabinoids, very little is known about

the exact mechanisms involved and how different neurotransmitters might interact. Additionally, individual variations in the experiences of runner's high speak for a complex interaction of genetic, physiological, and psychological factors, which are not well understood to this day. In most studies, data is based on self-reports, which may further add bias to the investigation and decrease the overall reliability of the findings. This would call for the incorporation of more objective measures, such as biochemical assays and neuroimaging, in future studies of the phenomenon to investigate the underlying physiological changes. In this respect, the establishment of mental health and/or general well-being differences between individuals exposed more/less frequently to the after-effects of runner's high could be explored in longitudinal studies. One other limitation is that the demographic background of research participants often has been very narrow, sometimes confined to specific populations like young healthy athletes. Further findings could be generalized through such samples of older adults, those with chronic health conditions, and those of other cultural backgrounds. Finally, the possible therapeutic application of a runner's high induction method that does not require running for long lengths may provide a novel area of intervention in mental health for people who cannot manage to run significant distances.

Conclusion: This focused review condenses the present knowledge of runner's high and mainly puts the accent on the complex interplay of physiological and psychological factors. While the secretion of endorphins has been seen as the main mechanism so far, recent investigations bring evidence for a major contribution of endocannabinoids and other neurotransmitters to the generation of a euphoric state after prolonged exercise. This review also identifies a broad range of methodologies that have been applied to these studies, extending from qualitative assessments of subjective experiences to neuroimaging methods. In this respect, the necessity is realized for standardized methodologies that increase comparability within and between studies. Physiological discoveries that support the idea of runner's high as being subjective and intricate are based on individual differences: physical condition, psychological state of mind, and genetic predisposition. It points out knowledge gaps to be filled to fully investigate variations in the consistency and intensity of runners high in a range of exercise environments and demographics. It will advance research and practice in the development of focused therapies to increase the positive effects of exercise on mental health and general well-being. First, mechanisms of runner's high could be investigated still more conceptually and methodologically in the future to help at the core of its applicability for both therapeutic interventions in a clinical context and athletic training regimens.

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