

# Effects of cannabis (cbd and thc) on the athlete's body: its possible influences in sport

Efeitos da cannabis (cbd e thc) no corpo do atleta: suas possíveis influências no esporte

Efectos del cannabis (cbd y thc) en el cuerpo del deportista: sus posibles influencias en el deporte

## RESUMO

Objetivo: Discutir os efeitos do CBD e THC no atleta e suas influências no esporte. Método: Realizou-se uma revisão de literatura no Google Acadêmico, ScienceDirect, PubMed, e na rede de pesquisas ResearchGate, bem como buscas nas listas de referências dos trabalhos pré-selecionados sobre a temática, utilizando como descritores: canabidiol, THC, athletes e sports para verificar estado da arte. Foram utilizadas publicações em língua inglesa. As pesquisas foram realizadas entre abril e novembro de 2022. Resultado: o CBD é utilizado como adjuvante para tratamento de distúrbios, fornecendo propriedades antioxidantes, analgésicas, anti-inflamatórias e neuroprotetoras em ambientes esportivos e clínicos. Tais benefícios são observados tanto na utilização especificamente do CBD, como também, combinado com THC. Conclusão: CBD e THC podem exercer efeitos fisiológicos, bioquímicos e psicológicos que beneficiam atletas, entretanto, estudos com esportistas são necessários antes que conclusões definitivas possam ser alcançadas sobre a utilidade efeitos do CBD e THC ao desempenho atlético.

**DESCRITORES:** Canabidiol; THC; Atletas; Esportes.

## ABSTRACT

Objective: To discuss the effects of CBD and THC on the athlete and their influences on the sport. Method: A literature review was carried out on Google Scholar, ScienceDirect, PubMed, and on the ResearchGate research network, as well as searches on the reference lists of pre-selected works on the subject, using as descriptors: cannabidiol, THC, athletes and sports to check state of the art. Publications in English were used. Research was carried out between April and November 2022. Results: CBD is used as an adjuvant for the treatment of disorders, providing antioxidant, analgesic, anti-inflammatory and neuroprotective properties in sports and clinical environments. Such benefits are observed both in the specific use of CBD, as well as in combination with THC. Conclusion: CBD and THC can exert physiological, biochemical and psychological effects that benefit athletes, however, studies with sportsmen are needed before definitive conclusions can be reached about the usefulness of CBD and THC effects to athletic performance.

**DESCRIPTORS:** Cannabidiol; THC; Athletes; Sports.

## RESUMEN

Objetivo: Discutir los efectos del CBD y THC en el atleta y sus influencias en el deporte. Método: Se realizó una revisión bibliográfica en Google Scholar, ScienceDirect, PubMed y en la red de investigación ResearchGate, así como búsquedas en las listas de referencias de los trabajos preseleccionados sobre el tema, utilizando como descriptores: cannabidiol, THC, atletas y deportes para verificar el estado del arte. Se utilizaron publicaciones en inglés. La investigación se realizó entre abril y noviembre de 2022. Resultados: El CBD se utiliza como coadyuvante en el tratamiento de trastornos, aportando propiedades antioxidantes, analgésicas, antiinflamatorias y neuroprotectoras en el ámbito deportivo y clínico. Tales beneficios se observan tanto cuando se utiliza CBD específicamente, como en combinación con THC. Conclusión: El CBD y el THC pueden ejercer efectos fisiológicos, bioquímicos y psicológicos que beneficien a los atletas, sin embargo, se necesitan estudios con atletas antes de llegar a conclusiones definitivas sobre la utilidad de los efectos del CBD y el THC en el rendimiento deportivo.

**DESCRIPTORES:** Cannabidiol; THC; Atletas; Deportes.

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## Everton de Souza da Silva

Graduating from the Bachelor of Sport course at the School of Physical Education and Sport of the UNIVERSITY of São Paulo (EEFE / usp), Graduated in Physical Education - Degree from the Bandeirante Anhanguera University (UNIBAN / UNIAN- SP) and Postgraduate in Medicinal Cannabis from the São Judas Tadeu University (USJT).

ORCID: 0000-0001-9029-1494



## INTRODUCTION

In recent years, cannabidiol (CBD) has been researched more frequently as a supplement for the treatment of disorders, providing antioxidant, analgesic, anti-inflammatory and neuroprotective properties in both sports and clinical settings. With regard to high-performance sports, evidence suggests that the use of CBD has grown exponentially, likely due to its removal from the World Anti-Doping Agency (WADA) Prohibited List in 2018<sup>1</sup>.

De fato, existem poucos dados sobre. Indeed, there is little data on its effectiveness, and previous reviews have concluded that there is a lack of evidence on performance-enhancing effects. Based on this lack of data and its negative effects on cognition, including impaired decision-making and alertness, as well as its illegal drug status (where applicable), cannabis consumption is not advisable for professional and amateur athletes. However, in addition to all these regulations and concerns regarding its effectiveness, cannabis smoking and the consumption of supplements containing cannabinoids seem to be popular in public and elite sports.<sup>2</sup>

The potential benefits of cannabis in sports have certainly spurred interest around cannabidiol (CBD), which is one of the cannabinoid compounds naturally found in *Cannabis sativa*. CBD is structurally related to the main psychoactive compound

$\Delta$ 9-tetrahydrocannabinol (THC), which is responsible for the adverse effects of cannabis. CBD is not psychoactive, but some preclinical evidence suggests that it may be responsible for some of the beneficial effects of cannabis for sporting activities, such as decreased anxiety and fear memory extinction.<sup>3</sup>

Additional advertised effects of CBD for athletes include anti-inflammatory properties, the alleviation of arthritis and pain-related behaviors, as well as post-exercise recovery. Consumer interest in CBD has increased considerably since 2015 and continues to accelerate.<sup>4</sup>

Early-stage clinical studies suggest that CBD may be anxiolytic in “stress-inducing” situations and in individuals with anxiety disorders. While some case reports indicate that CBD improves sleep, robust evidence is currently lacking. Cognitive function and thermoregulation appear to be unaffected by CBD, while effects on food intake, metabolic function, cardiovascular function and infection.<sup>5</sup>

CBD can exert several physiological, biochemical and psychological effects with the potential to benefit athletes, and these effects can be enhanced with the combined use of THC.<sup>6</sup> However, more studies and research with sportsmen are needed before definitive conclusions can be reached about the usefulness of CBD and THC in supporting athletic performance. In this context, the present

study seeks, through a narrative literature review, to understand the effects of CBD and THC on the athlete's body and their possible influences on high-level sport.

## METHOD

To fulfill the main objective of the research, a narrative review of the literature was carried out. Narrative literature review studies aim to present and discuss the state of the art on a given subject.<sup>7</sup> In view of the inaccurate data on the subject and especially the difficulty in establishing a specific research question, this research method was used to enable an expanded discussion on the subject.

The review was carried out in a non-systematic way in November 2022. The searches were based on the research question: What are the effects of Cannabis (CBD and THC) on the athlete's body and its possible influences on sport? The bibliographic search was carried out in the databases of Google Scholar, ScienceDirect, PubMed, as well as in the research sharing network ResearchGate, plus manual searches in the reference lists of pre-selected works on the subject. The search had as search descriptors: CBD, THC, athlete and sports. The searches were carried out by the author, without limitation of date and place of study. Original and review articles and literature all in English were

included in the study. The selection of articles covered the period from 1976 to 2021.

Narrative literature review studies are considered to have less scientific weight due to the arbitrary selection of articles and because they are subject to selection bias.<sup>7</sup> However, they are of great value for contributions and debates on certain topics in order to raise questions and cooperate to increase and update knowledge.<sup>7</sup>

Considering the theme, the study was organized into three sections, the first section where the properties and effects of using CBD and THC are identified. The second section presents elements on the use of Cannabidiol by athletes. The third section presents a discussion listing the possible benefits and harms of the use of such substances by athletes. In the final considerations, some perspectives are indicated for the debate on the effects of cannabinoids on sports performance.

## RESULTS – LITERATURE REVIEW

### Properties and effects of using CBD and THC

Herbal remedies and nutraceuticals have been prevalent in many cultures for hundreds of years. The cannabis plant, in particular, has been used for the treatment of illnesses and in the search for pain relief. This plant contains over 140 cannabinoids, most notably  $\Delta^9$ -tetrahydrocannabinol (commonly referred to as THC) and cannabidiol (commonly referred to as CBD). THC has been identified as the main cannabinoid responsible for the psychotropic effect of cannabis, therefore it is found in high concentrations in indica (> 0.3%) and low concentrations in sativa (< 0.3%). CBD has been cited as a non-intoxicating constituent of the cannabis plant with potential therapeutic value.<sup>9</sup>

D9-THC, also known as THC, is the most pharmacologically and toxicologically relevant compound found in cannabis. This can cause various effects in animals and humans. In order to characterize the biological effects of THC, it is customary to differentiate between so-called central and peripheral effects, which reflect the physiological distribution of the cannabinoid binding re-

ceptors CB1 and CB2.<sup>10</sup>

However, the main effects attributed to CB1 are those that are directly related to the psychological effects caused by the consumption of Cannabis sativa in humans. The effects can be divided into four categories: affective, sensorial, somatic and cognitive. Indeed, most of the documented consequences of cannabinoids are mediated by CB1.<sup>10</sup>

Thus, behavioral effects caused by cannabis, especially THC, are generally consistent with the anatomical distribution of CB1, notably in the brain. However, some neurological protective actions in situations of ischemia and hypoxia are known examples of THC and other cannabinoids, without depending on the receptor.<sup>11</sup>

THC also offers therapeutic benefits to cancer patients, specifically during chemotherapy, by acting to inhibit vomiting and nausea. In this regard, the management of Cannabis sativa consumed by ingestion or inhalation proved to be effective in reducing discomfort in a large number of cancer patients who resorted to it for this purpose, as proven by clinical studies.<sup>12</sup>

In addition, THC also has biological activity stimulating appetite and inhibiting pain. It is possible to notice an increase in the metabolic rate in the brain, with the administration of THC to animals and humans where it decreases the body temperature, but only in higher doses. The elevated heart rate after THC administration is totally dependent on the ingested dosage and is linked to the plasma concentrations of THC present in the blood. As a result of the use of this substance, cardiovascular problems may arise, which is a contraindication for the therapeutic use of Indian hemp.<sup>12</sup>

It is suggested, based on a clinical study where inhaled THC was administered, that the increase in heart rate is not controlled by brainstem centers, but rather by a direct consequence of THC in the heart.<sup>13</sup> In the study in question, the effects on the central nervous system (CNS) after the administration of THC were monitored. The effects depend on the dosage administered, as well as the concentration in the blood, directly impacting body stability and body balance. These results are due to the high density of

CB1 receptors in the basal, cerebellar, tonsillar and encephalic ganglia.<sup>3</sup>

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On the other hand, THC can also cause undesirable effects such as anxiety, panic and paranoia.

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There are indications that, in certain cases, THC can trigger psychotic events, mainly delusions and hallucinations. For this to happen, it is necessary to administer large doses of the product and its prolonged use or even a previous genetic predisposition.<sup>14</sup>

In addition to the effects already described, THC also lowers intraocular pressure and improves blood circulation in the eye. These effects can protect the retina (part of the eye) and the optic nerve (nerve that transmits visual information to the brain). Several studies have indicated that THC and other cannabinoids can be effective in the treatment of glaucoma, one of the main causes of irreversible blindness. In addition, psychotropic and non-psychotropic cannabinoids have anticonvulsant effects, including CBD, THC, D8-THC and CBN.<sup>10</sup>

THC acts on muscle relaxation, generating effects that inhibit involuntary body movements (hypokinetic) and also anticonvulsants. The properties indicate that the compound could be studied as a treatment for multiple sclerosis, as well as other conditions such as epilepsy. Category CB2 receptors are present on leukocytes and influence the immune system, perhaps explaining why Cannabis sativa is often used by people with low immunity.<sup>10</sup>

THC is a substance whose main characte-

istics are the fact that it modifies the function of cells of the immune system, being able to either increase or suppress this activity. These effects, however, are not only determined by the THC present in cannabis, but by other chemical compounds that are also present in the plant. In addition to the already known biological effects of THC, it also relaxes the colon (large intestine) and decreases its motility after meals. This shows a potential for CB receptors to modulate colonic motor errands in intestinal diseases such as Crohn's disease or irritable bowel syndrome.<sup>15</sup>

CBD is one of the major non-psychotropic cannabinoids found in Indian hemp and is present in the carboxylic acid form CBDA in Cannabis sativa. The main effects of CBD listed are anti-inflammatory, analgesic, neuroprotective, sedative, hypnotic and anxiolytic actions. Furthermore, CBD also has scientifically proven antipsychotic benefits. CBD also has a relevant effect in oncology, as it manages to reduce the aggressiveness of cancer cell growth, as demonstrated by a study carried out with breast cancer, inhibiting a crucial protein for its development.<sup>16</sup>

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In an analysis on the effect of CBD on the physical restoration of athletes in competitions, it was observed that this compound is promising and has the capacity to intensify the efficiency of the restoration process during exercise and suppress post-training fatigue, due to its anti-inflammatory, anxiolytic and analgesic properties.<sup>17</sup>

As for the side effects of CBD, research points out that this compound is very well supported and has relatively few adverse effects, most importantly, diarrhea. However, this study also found that CBD has the ability

to inhibit the hepatic metabolism of other drugs (eg clobazam and sodium valproate) when taken together. This means that more research is needed, especially on the use of CBD in cases of epilepsy<sup>18</sup>.

## **Cannabidiol (CBD) and its use by athletes**

In recent years, CBD isolate has been researched more frequently as a supplement for the treatment of disorders, as it provides antioxidant, analgesic, anti-inflammatory and neuroprotective properties in both sports and clinical settings. In terms of elite sports, evidence suggests that CBD use has grown exponentially<sup>19</sup>, likely due to its removal from the list of prohibited substances by the World Anti-Doping Agency - WADA 1, with the ever-evolving legal landscape.

In this sense, according to studies carried out on the subject in question, exercise, especially when it involves unusual movements and/or extreme strength, can cause severe damage to skeletal muscle myofibrils (the structure responsible for muscle contraction) and the extracellular matrix (connective tissue found between cells). Such exercise-induced muscle damage, which impairs muscle function and initiates an inflammatory response. Excessive inflammation can disrupt functional recovery, causing prolonged pain.<sup>20</sup>

Given the context presented, it is possible to infer that inhibitions in oxidative stress and neuroinflammation related to CBD may have some therapeutic potential in sports research.<sup>21</sup> Evidence for this argument is based on the suggestion that CBD can cause changes in the way cortisol is released, regulating the inflammatory response to injury. This mediation is due to the interaction between the cannabinoids CBD CB1 and CB2 and adenosine receptors, resulting in reduced levels of cytokines and a negative regulation of hyperreactive immune cells.<sup>16</sup> Furthermore, ingestion of CBD appears to have positive effects on processes related to protection against gastrointestinal damage caused by inflammation, as well as healing of skeletal injuries.<sup>22</sup>

Regarding the damage caused to the sarcolemma during physical exercise, especially those with a high component of eccentric

contraction, which results in disruption of cell membrane permeability, it reduces the Ca<sup>2+</sup> of the electrochemical gradient of the muscle fiber, which can lead to irreversible injuries if the damage is sufficiently high. However, otherwise ATPases act to reverse this process. Also, if there is an overload of Ca<sup>2+</sup>, the contractile proteins can be damaged. This damage can stimulate the activation of macrophages and other phagocytic cells, which is called an inflammatory cascade.<sup>16</sup>

Furthermore, CBD can induce changes in cortisol glucocorticoids in humans, contributing to the regulation of the inflammatory response to injury. Furthermore, a recent review in sport suggests that this compound may also have anti-inflammatory effects in humans, improving performance in athletes.<sup>22</sup> This statement is based on the suggestion that CBD can interact with receptors involved in controlling inflammation, such as the cannabinoids CB1 and CB2, adenosine A2A, in addition to reducing the levels of cytokines IL-1 (interleukin-1) and TNF $\alpha$  (tumor necrosis factor alpha). Another mechanism by which CBD acts to decrease inflammation is by regulating overactive immune cells, a process popularly known as "suppressing the immune system". In this way, it minimizes the impact of damage from the secondary and above mechanisms.<sup>16</sup>

There is also evidence suggesting that CBD can promote the release of arachidonic acid, which as far as you are concerned leads to greater healing ability. This would be possible due to the central regulation of growth signals mediated by pro-resolving substances (such as lipoxin A4 and 15d-P-GJ2). Furthermore, interactions between inflammation and oxidative stress underlie several human diseases. Thus, in sport, there is a hypothesis that inhibitions related to the use of CBD (in oxidative stress and neuroinflammation) could have some therapeutic potential in sports studies.<sup>21</sup>

## **DISCUSSION**

Within the cutting-edge sports scene, where athletes are forced to constantly train and compete, performance may depend in

part on an athlete's ability to complete multiple sets of muscle-damaging exercises. Therefore, symptoms of muscle damage resulting from exercise are commonplace, including muscle pain, general aches and pains, and inflammation.<sup>23</sup>

According to Owens et al. (2019)<sup>23</sup>, nutrition is a pathway that has been shown to mitigate acute muscle damage with common nutritional strategies including providing extra protein, polyphenols, amino acids, creatine monohydrate, vitamins D, E, and C, and omega-3 fatty acids. Generally, strategies used to regain muscle function are aimed at reducing inflammation. However, opiates and non-steroidal anti-inflammatory drugs (NSAIDs) are also frequently used in sports settings for pain management.

Although short-term analgesic medications are reported to be safe<sup>24</sup>, when used for a long time they can cause various health problems such as nausea, constipation and headaches. In addition, the chronic use of these drugs is related to an increased risk of bleeding and intracranial hemorrhage after mild head trauma.<sup>25</sup>

Given that pain is a common symptom among athletes, many of them have been looking for alternatives to alleviate it, one of them being CBD. However, despite the mechanistic logic (which suggests that this type of treatment works), there is little scientific evidence to support the anti-inflammatory effects of CBD in humans. Most studies on the subject have been carried out using *in vitro* (experimental) preclinical models.<sup>16</sup>

Furthermore, most studies on the effects of CBD on pain have been done with animals, but even so, the findings are promising. Some work suggests that a combined dose of CBD and THC can reduce allodynia (sensitivity to pain) in mice.<sup>6</sup>

Despite the various reports on the use of CBD by professional athletes, there is still little concrete data to confirm this trend. A recent survey recruited 500 rugby players in Europe to investigate this phenomenon and discover the main reasons why athletes use or intend to use CBD.<sup>26</sup>

Although most sports teams discourage the use of CBD (cannabidiol) because of the risks of inadvertent doping and the lack of

data on its effectiveness), research indicates that over 25% of players have used it at some point.<sup>26</sup> Furthermore, in athletes over 28 years old, approximately 40% of them used or continue to use CBD, the main reasons cited being pain relief/recovery and improved sleep quality. Worryingly, the athletes involved in this study revealed that the main source of data about CBD was the internet (73%) or a teammate (61%), with only 16% and 4%, respectively, seeking guidance from the team's nutritionist.<sup>26</sup>

The low demand for nutritionists could be a consequence of the fact that most clubs and government bodies do not recommend the use of CBD, making players feel uncomfortable discussing the potential use of the cannabidiol product with team members. Perhaps this is the explanation why some teams have reported a usage rate as high as 61%. Which may indicate an influential individual within this group, promoting its enjoyment.<sup>26</sup>

According to Kasper et al. (2020)<sup>26</sup>, taken as a whole, these data indicate that many athletes may be willing to take CBD-related risks in hopes of speeding up recovery and/or improving sleep, while reducing the use of conventional pain medications, which can be addictive and have serious side effects.

Still, according to the aforementioned author, he believes that the athlete's support staff should create environments in which they feel free to discuss the use of CBD with a qualified team, rather than relying on the Internet and/or other team members for information.<sup>26</sup>

Based on the aforementioned data, the use of CBD and THC, in some way, can bring benefits to the performance of athletes, because, even without medical follow-up and without much information about these substances, they continue to use these compounds, and, influencing teammates on improving performance.

However, there are still not enough data to support the effectiveness of the compounds in the performance of athletes and, in addition, their indiscriminate use, without support from a specialized professional, can result in complications, such as anxiety, panic, paranoia, among others.

## CONCLUSION

The present study aimed to understand the effects of using CBD and THC on the athlete's body and the possible influences of these substances in high-performance sports. For this, a bibliographical research was carried out with several articles made focusing on the use of these substances by individuals, university students and athletes.

Based on the data found, it was possible to verify that within the cutting-edge sports scenario, where athletes are forced to be constantly trained and compete, muscle pain, pain in general and inflammation are part of their daily lives, due to this fact, many of these athletes choose to resort to medications that bring some relief to this pain, even without a medical prescription.

Another important fact to be mentioned is that individuals who practice high-level sports need to find time to sleep with quality and have a higher caloric intake than less active people. In this context, it is common for athletes to look for substances that help stimulate hunger and sleep to improve their performance.

Several professional athletes report using CBD and THC to improve their sporting potential. Most of these use these substances based on internet data, without the help of a medical professional, making this a worrying situation.

When analyzed in general, the data on the subject indicate that many athletes may be willing to take risks related to CBD and THC in the hope of improving their recovery and/or reducing the use of conventional pain relief medications, which can be addictive and have serious side effects.

It is possible that the use of CBD and THC help in some way in the performance of athletes, since they continue their use even without consulting a doctor or having much information about the substances. However, due to the limitations present in the literature and the lack of clinical evidence of its use in humans, it is premature to defend the use of CBD and/or THC as an alternative to improve the performance of athletes. Studies are needed to investigate any potential beneficial effects of CBD and THC directly

associated with sport, including research to define an efficient dose.

The lack of controlled data regarding the safety of CBD at subclinical doses does not allow us to be sure of the safe-

ty of chronic supplementation of this compound, with regard to THC, data are even scarcer and there is no consensus on its possible benefits and a possible safe dosage for its use. There is also no in-

formation on possible drug interactions, subpopulation sensitivities and/or effective doses that coincide with those capable of causing clinical toxicity at higher levels.

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