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CHEST COMPUTED TOMOGRAPHY FINDINGS IN CANNABIS SMOKERS : SYSTEMATIC REVIEW

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ABSTRACT

Introduction: *In contrast, cannabinoids and nicotine are chemically distinct compounds, with cannabinoids exhibiting a unique set of effects pertaining to aspects such as gene expression, inflammatory mechanisms, immunological modulation, and cellular energy and survival. Consequently, a comparison between the pulmonary effects of cannabis and tobacco consumption is crucial. As a sensitive and repeatable tool for quantifying the airway alterations and alveolar lung damage that are hallmarks of smoking-related emphysema and COPD, noninvasive lung imaging with HRCT scans has developed. In-depth analyses of HRCT images obtained from cannabis consumers were conducted in only two studies.*

The aim: *This study review chest CT findings in cannabis smokers.*

Methods: *For this systematic review, publications that were published from 2012 to 2023 were taken into account during the search process. This was achieved through the utilization of numerous online reference sources, such as Pubmed and SagePub. The decision was made to exclude review articles, previously published works, and incomplete works.*

Result: *We obtained 54 articles from Pubmed and 76 from SagePub. We extracted were 2 article from Pubmed and 4 articles from SagePub.*

Conclusion: *Research shows that patients can experience pneumothorax with bullae and blebs. Those who smoke marijuana can also experience emphysema and chronic bronchitis.*

Keyword: *Cannabis; Computed tomography; Lung; Smokers*

INTRODUCTION

In modern civilization, cannabis is the second most often smoked substance. According to a long-running US national survey, the fall in cannabis use from 1990 to 2005 was followed by a moderate but steady increase in frequent cannabis smoking.[1] This increase is especially noteworthy given the sharp drop in tobacco smoking that has happened throughout the same time period. In 2017, around one in every seventeen high school seniors and one in every thirteen young adults (ages 19-28) smoked cannabis on a daily or near-daily basis.[2,3]

It is common knowledge that marijuana is the most commonly used illegal substance on a global scale. Following tobacco, cannabis is the second most inhaled substance. In recent years, there has been a growing media focus on the recreational use of cannabis (also known as 'weed', 'dope', 'grass','spliff', 'toke', 'hash', 'hemp', 'bud', 'ganja', and numerous others). Given the relaxation of legislation in several countries, it seems probable that overall exposure to this topic will continue to rise. Nevertheless, there is a paucity of knowledge regarding the enduring consequences of cannabis consumption on the respiratory system and overall health.[2,3]

In addition to traditional cannabis smoking methods such as joints, blunts, bongs, and pipes, vaping is becoming popular as a method of releasing and inhaling cannabinoids from dried plant material or concentrated cannabinoid extracts (in the form of waxes or oils). This review focuses on the health effects of traditional cannabis smoking because there is essentially no research available on the pulmonary effects of vaped cannabis, despite the fact that it is considered as a healthier alternative. Cannabis smoking acts a simple and rapid delivery technique for cannabinoids.[4,5]

In this regard, the procedure is remarkably similar to traditional tobacco smoking, which serves as a vehicle for nicotine delivery. As they puff on lighted plant material, the smoker inhales a mixture of hazardous combustion products as well as the desired biologically active substances.[6] All of these inhaled components are most concentrated in the lungs. Given these similarities, there is evident worry about the impact of cannabis smoking on the development of airway inflammation, chronic bronchitis, emphysema, and cancer.[7,8]

Cannabinoids and nicotine, on the other hand, are completely separate chemicals, and cannabinoids have a distinct profile of effects on oxidative stress, cellular energetics and survival, gene expression, inflammatory processes, and immunological modulation.[9] As a result, it is critical to compare the pulmonary effects of cannabis to tobacco smoking. Non-invasive lung imaging with HRCT scans has evolved as a sensitive and repeatable method for measuring the airway alterations and alveolar lung damage that characterize smoking-related emphysema and COPD. Only two investigations evaluated HRCT pictures obtained from cannabis consumers in depth.[10]

Within the scope of this investigation, the usage of chest CT in cannabis smokers was investigated..

METHODS

PRISMA 2020 requirements for data acquisition, processing, and reporting were duly met. The implementation of further limitations was influenced by an extensive range of factors. A review of the utilization of chest computed tomography on cannabis users. In accordance with the study's key findings, all written materials concerning chest CT in cannabis consumers must be in English. The present systematic review evaluated academic articles published after 2013 that met the predetermined inclusion criteria of the research. The compilation will not include editorials, entries that do not have a DOI, previously published book reviews, or duplicate journal articles that are excessively extensive.

The search for studies to be included in the systematic review was carried out from December, 10th 2023 using the PubMed and SagePub databases by inputting the words: “chest”; “computed tomography”; “cannabis”; “marijuana”; “smokers”. Where *("chested"[All Fields] OR "thorax"[MeSH Terms] OR "thorax"[All Fields] OR "chest"[All Fields] OR "chests"[All Fields]) AND ("tomography, x ray computed"[MeSH Terms] OR ("tomography"[All Fields] AND "x ray"[All Fields] AND "computed"[All Fields]) OR "x-ray computed tomography"[All Fields] OR ("computed"[All Fields] AND "tomography"[All Fields]) OR "computed tomography"[All Fields]) AND ("cannabis"[MeSH Terms] OR "cannabis"[All Fields] OR "cannabi"[All Fields] OR "cannabis s"[All Fields]) AND ("cannabis"[MeSH Terms] OR "cannabis"[All Fields] OR "marijuana"[All Fields] OR "marijuana s"[All Fields]) AND ("smoker s"[All Fields] OR "smokers"[MeSH Terms] OR "smokers"[All Fields] OR "smoker"[All Fields])* is used as search keywords.

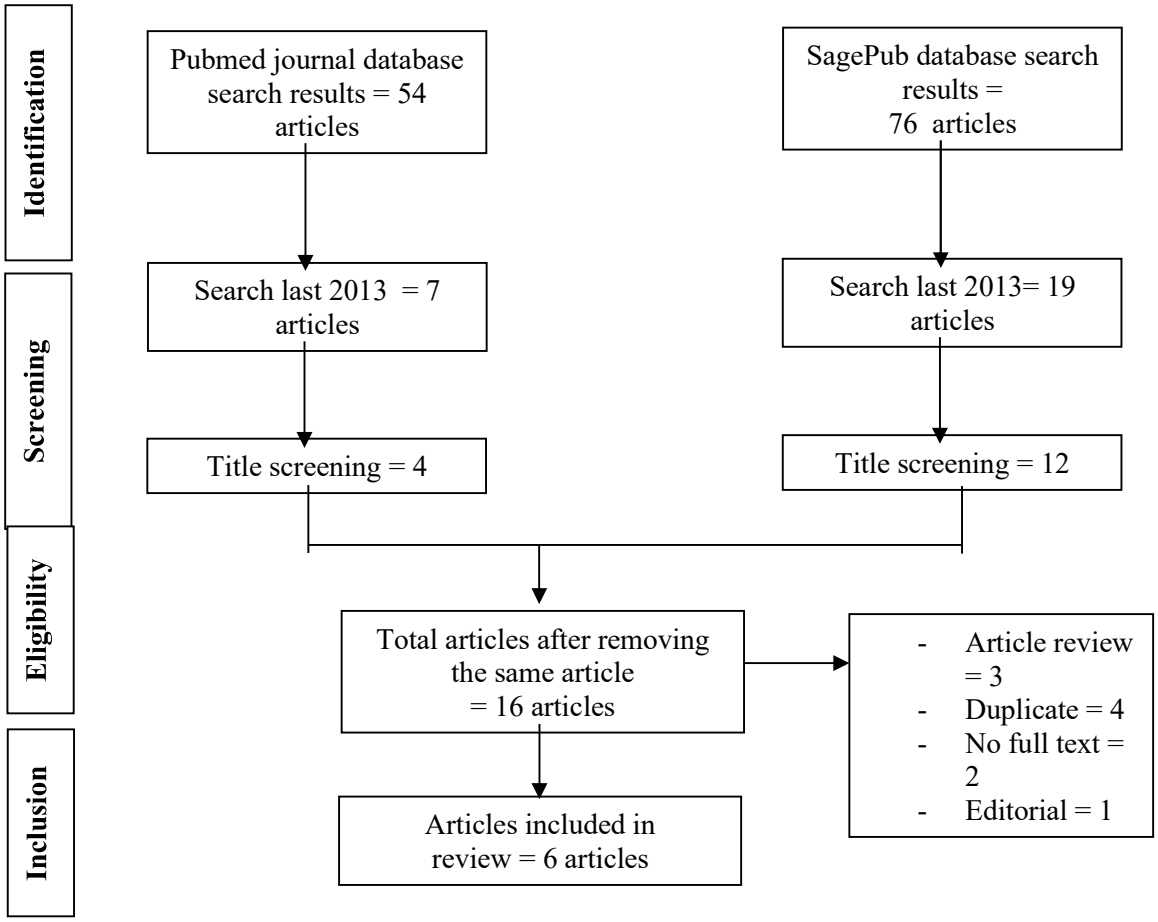

Figure 1. Article search flowchart

The acceptability of the studies was similarly influenced by their titles and abstracts. Therefore, they are obligated to rely on historical archives. Due to the consistent nature of research findings, submission of unpublished English papers is required. Strict adherence was maintained to the inclusion criteria during the study selection process for the systematic review. By doing so, the search is limited to results that meet the specified criteria exclusively. The assessment methodology is outlined in the following sections. The study meticulously considered various factors, including authors, publication dates, geographic locations, activities, and motivations.

After the search results were documented by EndNote, the database undertook the task of detecting and removing duplicate articles. Two individuals evaluated the titles and abstracts of each paper prior to the composition of this article. Before reaching coverage decisions, each author conducts a comprehensive assessment of pertinent abstracts and article titles. Each paper that satisfies the predetermined criteria for evaluation will be subjected to a comprehensive and rigorous analysis. We will reexamine any pertinent scientific publications that we may have overlooked during our initial examination once the investigation has been concluded. The exclusion of irrelevant research in favor of relevant research was justified.

RESULT

Murtha, et al (2021)[11] showed 75 percent of people who smoked marijuana (42 out of 56) had emphysema. This is in contrast to the 67 percent of people who smoked tobacco only (22 out of 33) and the five percent of those who did not smoke (three out of 57). Inflammation of the airways and emphysema were more prevalent in those who used marijuana than in people who did not smoke or who only smoked tobacco. However, our ability to make definitive findings is hindered by the fact that there was a level of disagreement between the observers and that the marijuana smokers also smoked cigarettes at the same time.

Stefani, et al (2020)[12] showed smoking marijuana appears to increase the risk of suffering from respiratory complaints and may have detrimental effects on the lung parenchyma, depending on the dose. Smoking marijuana also negatively impacts the outcome of patients operated on for spontaneous pneumothorax. This is what can show bullae and blebs on a CT scan of the patient's chest. A history of marijuana abuse should always be checked in patients with pneumothorax. Special treatment may be needed for pneumothorax in marijuana smokers.

Alqahtani, et al (2019)[13] presented two rare cases of cannabis use resulting in acute lung injury and DAH. When dealing with young patients who appear with DAH, clinicians should have a strong suspicion that the patient is abusing substances. Both of these examples shed light on the potentially lethal complication of DAH that can occur in individuals who utilize cannabis. A further in-depth examination into the relationship between cannabis use and DAH is required.

Table 1. The litelature include in this study

Author	Origin	Method	Sample	Conclusion
Murtha, 2022[11]	Canada	Retrospective study	56 marijuana smokers	Compared to 67 percent of tobacco-only smokers (22 of 33) and 5 percent of non-smokers (three of 57), 75% of marijuana smokers (42 of 56) had emphysema
Stefani, 2020[12]	Italy	Retrospective study	112 patients, 39 smoked cannabis, 23 smoked only tobacco and 50 were nonsmokers	Cannabis smokers presented with more severe chronic respiratory symptoms and bullous lung disease and with a higher incidence of tension pneumothorax than both tobacco smokers and nonsmokers. Cannabis smokers also developed a larger pneumothorax, experienced prolonged postoperative stay and demonstrated a higher incidence of pneumothorax recurrence after the operation than nonsmokers did.
Alqahtani, 2019[13]	United State	Case series	2 patients	Diffuse alveolar hemorrhage (DAH). Studies on rats showed that two major cannabinoids, cannabinol and THC, have antithrombotic activity.
Bucchino, 2019[14]	Italy	Case report	1 patients	Diffuse alveolar hemorrhage (DAH). DAH can be a complication in cannabis smokers
Ruppert, 2018[15]	France	Prospective study	83 patients	Emphysema was detected in 43/85 patients (51.8%),

				including 1/13 patients (7.7%) in the non-smoking group, 19/38 patients (50%) in the tobacco only group and 23/32 patients (71.9%) in the tobacco and cannabis smokers, with no difference between tobacco only and tobacco and cannabis smokers.
Eugene, 2015[16]	United State	Case series	4 patients	Diffuse centrilobular nodules and tree-in-bud pattern

Bucchino, et al (2019)[14] presented a 16-year-old boy with hemoptysis, dyspnea, and ARF shortly after undergoing general anesthesia-induced laparoscopic surgery for varicocele. The initial chest radiography revealed a suspected diagnosis of DAH, which was subsequently validated through the results of the CT scan and the bronchoalveolar lavage. His overall condition fully restored following a mere twenty-four hours of oxygen supplementation, intravenous corticosteroid administration, and antibiotic treatment.

Ruppert, et al (2018)[15] showed emphysema was detected in 43/85 patients (51.8%), including 1/13 patients (7.7%) in the non-smoking group, 19/38 patients (50%) in the tobacco only group and 23/32 patients (71.9%) in the tobacco and cannabis smokers, with no difference between tobacco only and tobacco and cannabis smokers. There is no significant difference in the prevalence of emphysema that can be seen on CT between people who smoke tobacco and those who use tobacco and cannabis. However, the onset of emphysema is earlier in people who smoke tobacco and cannabis. Based on this result, it appears that the combination of cannabis and tobacco may result in the development of emphysema at a younger age.

Eugene, et al (2015)[16] conducted a case series with four patients. Radiographic examination of the chest revealed a pattern of diffuse miliary-micronodularity. CT scans of the chest revealed the presence of tree-in-bud pattern and diffuse centrilobular nodules, as well as a histopathologic pattern of organized pneumonia with or without patchy acute alveolar injury. In the event that radiologists observe this particular imaging pattern, they should be alerted to consider the use of synthetic marijuana in their differential diagnosis.

DISCUSSION

It's well knowledge that cannabis and tobacco have comparable effects on respiratory health. This makes sense because, aside from the psychotropic components of nicotine and cannabinoids, tobacco smoke and cannabis smoke have similar components, albeit the amounts of these components can vary and can be affected by smoking habits. Due to the illegality of cannabis and the lack of standardization in cannabis cigarettes, or "joints", it can also be challenging to find reliable information about cannabis use. It has therefore been reasonable to presume that the respiratory effects of cannabis and tobacco would be comparable.[17,18]

Contrary to tobacco, cannabis is often smoked in a distinct manner. In most cases, cannabis is smoked without the use of a filter, with the butt length being reduced, and the temperature of the smoke being raised substantially. Moreover, those who consume cannabis take deeper breaths, hold their breath for longer periods of time, and perform the Valsalva maneuver while holding their breath for the longest possible time. The consequences of smoking cigarettes (also known as tobacco) on the health of the lungs are well established. Symptoms such as coughing, wheezing, shortness of breath, and production of sputum (which, when present in significant amounts, characterizes chronic bronchitis) are included in this category.[17,18]

It's possible that there has also been a propensity to adopt a moral position against an illicit substance that could have negative social and psychological repercussions and to believe that cannabis use will be just as damaging as tobacco use (a phenomenon known as "white hat bias"). The research, on the other hand, tells a different narrative. Chronic Obstructive Pulmonary Disease (COPD) and lung cancer are the most common significant respiratory consequences of tobacco use.[19]

There is little epidemiological evidence that smoking cannabis causes either of these. However, there is significant evidence that smoking cannabis can produce respiratory symptoms as well as other pulmonary consequences.[20]

Case studies and case series have found a link between cannabis use and bullous lung disease. Bullae are huge, non-functioning airspaces in the lung that often develop as a result of emphysema and lung tissue loss induced by cigarette smoking. Despite case reports, there is minimal epidemiological evidence linking cannabis usage to emphysema.[12] Cannabis use is known to irritate the bronchial tree and is strongly linked to the symptoms of chronic bronchitis. Histological examinations reveal indications of airway inflammation and remodeling in patients who smoke cannabis.[21]

There have also been reports of altered fungicidal and antibacterial activity of alveolar macrophages, together with an increased susceptibility to respiratory infections. Among immunocompromised individuals, the relationship with invasive pulmonary aspergillosis is a cause for particular worry. Numerous studies have found that persistent use of cannabis is related with poor control of asthma, despite the fact that it has been demonstrated to offer a fast bronchodilator effect. Additionally, smoking cannabis is a risk factor for the development of complications such as hypersensitivity pneumonitis, spontaneous pneumothorax, and bullous lung disease.[21]

Diffuse alveolar hemorrhage, also known as DAH, is an extremely uncommon but potentially fatal consequence of frequent cannabis usage. DAH is defined by bleeding into the alveoli as a result of the disruption of the alveolar-capillary basement membrane, which occurs as a consequence of an injury that occurs at the level of the alveolar microcirculation. Included in the list of potential diagnoses for DAH are systemic vasculitis, bland pulmonary hemorrhage, and injury to the alveoli. The effects of cannabis on respiratory function include an increase in alveolar permeability, an increase in inflammatory edema, and an increase in mucus secretion during the respiratory process.[14]

Hypoxemia, respiratory failure, and hemoptysis in the lungs are all symptoms that are associated with severe diffuse alveolar hemorrhage. Additionally, diffuse alveolar infiltrates are a characteristic of this condition. The pulmonary microcirculation is the source of DAH, which can be localized or diffuse. The arterioles, venules, and alveolar capillaries are all included in this microcirculation. There is a high prevalence of autoimmune and non-autoimmune causes of DAH, which include cancer, infections, coagulation disorders, cardiovascular diseases, and the use of illegal substances, respectively.[22]

As the use of cannabis continues to rise, it is imperative that medical professionals are well-versed in the effects that both tobacco and cannabis have on the lungs. On the other hand, there have been very few studies that have been conducted over an extended period of time on the consequences of smoking cannabis. This is primarily owing to the fact that there are legality difficulties and the effects of tobacco that can be confusing. In the past, it was believed that cannabis and tobacco had comparable long-term consequences due to the fact that both cannabis and tobacco cause chronic bronchitis.[23]

On the other hand, substantial research conducted in recent years has demonstrated that the consumption of marijuana is linked to an increase in forced vital capacity (FVC), rather than a reduction in forced expiratory volume in one second (FVC). Although it is not known what causes this, it is possible that the acute bronchodilator and anti-inflammatory properties of cannabis are responsible for it. Within the context of case reports and small series, the conditions of bullous lung illness, barotrauma, and cannabis smoking have been identified. It is necessary to conduct additional research in order to investigate the effects of cannabis on lung function, imaging, and histology conditions.[23]

CONCLUSION

Research shows that patients can experience pneumothorax with bullae and blebs. Those who smoke marijuana can also experience emphysema and chronic bronchitis.

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