


## Action of coffee associated with pepper in patients affected with COVID-19: a literature review

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### ABSTRACT

In 2019, an abnormal number of cases of respiratory complications with subsequent deaths were observed in China. The disease was named COVID-19 and its causative agent identified as SARS-COV-2, a novel coronavirus whose high virulence has resulted in a worldwide pandemic. Despite global efforts, there is still no specific therapeutic treatment for the disease, and efforts are focused on prophylactic treatments. Among the preventive alternatives is the use of

functional foods. The objective of this literature review was to collect scientific information about the benefits of coffee and pepper on the human body, which could be associated with the relief of symptoms of COVID-19. A systematic literature search was carried out from March to December 2022 in BIREME, PubMed, LILACS, SCIELO, and EBSCON. The articles were selected according to pre-established suitability criteria. Of the 302 articles obtained, 16 were used, allowing the identification of beneficial effects of coffee components (theophylline and caffeine) of pepper (capsaicin). The data suggest that the association of these components can contribute to the relief of the symptomatological picture of patients with COVID-19, by the vasodilatory and anti-inflammatory actions, and in the potentiation of the immune system in fighting the virus.

**Keywords:** adjuvant treatment, natural therapy, new coronavirus, natural substances. Sars-cov-2;

### 1 INTRODUCTION

The novel coronavirus Sars-Cov-2 was first identified in Wuhan, China in late 2019 as the cause of COVID-19 disease. Its high virulence has resulted in a pandemic, leading to millions of deaths<sup>1,2</sup>.

To date there is no specific treatment for the disease, leading to a global union of several scientists in search of an effective treatment that produces as few side effects as possible<sup>1</sup>.

The growing market of natural products, allied to the consumers' interests in the prevention of diseases, made the food industry search for healthier products, known as functional foods, directing researches in this segment. According to the National Health Surveillance Agency (ANVISA), functional foods are those that produce metabolic or physiological effects through the action of a nutrient or non nutrient on growth, development, maintenance and other normal functions of the human organism. Functional foods have gained prestige for the beneficial effects they promote to health. Among these foods, coffee and red pepper stand out<sup>3</sup>. A study has shown the combination between coffee and pepper as a caloric energy contribution to the human organism. It was evidenced the potential of this combination to

considerably reduce the intake of high-energy compounds, such as lipids and carbohydrates, when compared to a control day without these compounds, helping in weight loss. 18

Among the substances present in the biochemical composition of coffee, theophylline and caffeine stand out. Both have an action on the central nervous system (CNS), and broncho dilatory and circulatory effects that contribute to a balance in the human body 4 . Capsaicin is the main component of pepper that presents beneficial effects to human health. Capsaicin exhibits the ability to promote antioxidant effects that protect our cells from the damaging actions of free radicals, and to provoke vasodilating and analgesic effects on the CNS. Pepper is rich in vitamins, which act to strengthen the immune system<sup>5</sup> . A recent study with experiments in laboratory showed that the substance present in coffee, the 5-caffeoylquinic acid, inhibit the interaction between the spike protein of the new coronavirus and the ACE-2 receptor present in the human cell, inhibiting the infection process. 17

It is believed that the union of coffee and pepper produces a potentiation of the beneficial effects of the associated substances and that it contributes to the relief of the symptoms of COVID-19. This study aims at a literature review that gathers evidence about the benefits of the substances present in coffee and pepper on the human organism and their possible benefits in patients with COVID-19.

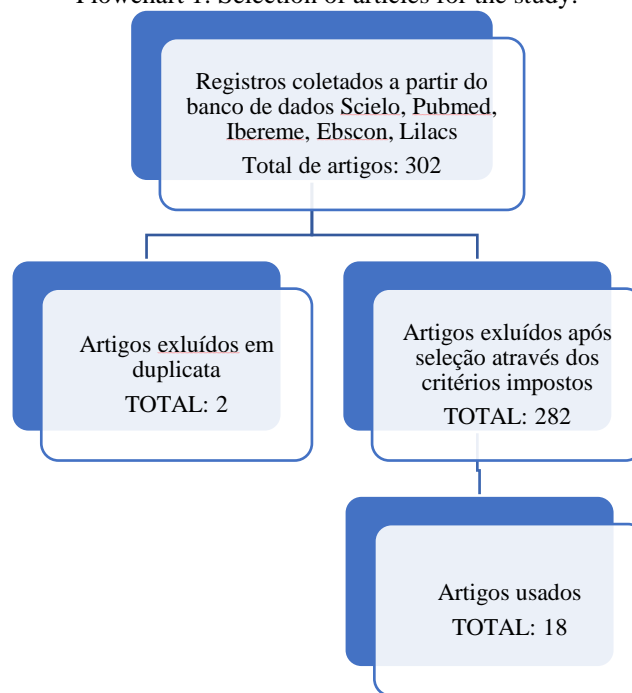
## **2 MATERIAL AND METHODS**

A systematic literature search was conducted from March 2020 to December 2022, in BIREME, PubMed, LILACS, SCIELO, and EBSCON. This search prioritized studies published in the last 18 years (2004-2022), which involved the association between the benefits of coffee and pepper on the human body.

In order to clearly define the adequacy of the literature found for this review study, the following inclusion criteria were established: a) articles with human beings and animals; b) articles published in the last 18 years (2004-2022); c) patients of both genders; d) articles published in English, Portuguese and Spanish. The exclusion criteria were developed to eliminate articles that did not use in their methodology the parameters listed above and that did not include the descriptors. These descriptors were used individually or combined.

302 articles were found in the initial search and, after evaluating the inclusion and exclusion criteria, 18 articles were selected. The selection process of the articles occurred individually.

Flowchart 1: Selection of articles for the study.



The selected articles were grouped in three categories a) virulence and symptomatology in patients affected by COVID-19; b) the importance of adjuvant treatments for COVID-19; c) benefits of pepper and coffee to the human body. The purpose of this grouping was to facilitate the understanding of how substances from coffee and pepper can contribute to the relief of symptoms in patients affected by COVID-19.

### 3 RESULTS AND DISCUSSION

#### 3.1 VIRULENCE AND SYMPTOMATOLOGY IN COVID-19 PATIENTS

The increasing number of countries with the occurrence of COVID-19, tripling the number of people infected, led the World Health Organization (WHO) to declare a Public Health Emergency (PHEIC) on January 30, 2020 characterizing a worldwide pandemic, causing more than six million deaths according to the WHO.

In this perspective, patients with pre-existing diseases such as hypertension, diabetes, and asthma, as well as the elderly, smokers, and those considered to be at risk, are among the main cases that can have their health condition aggravated, leading to hospitalization, often in the ICU.<sup>7</sup>

The most common form of transmission is through the air or through personal contact with body secretions such as saliva droplets, sneezing, coughing, close contact such as touching or shaking hands, followed by touching contaminated surfaces, from which hands can be taken to mucous membranes<sup>2</sup>. The average incubation period of Sars-Cov-2 is 03 to 09 days, and can reach up to 14 days.<sup>2</sup>

Research<sup>8</sup> has shown that patients affected by COVID-19 may not have a permanent immunological memory for the virus. The antibodies may not recognize the virus in the body after three months, especially

in patients who have been asymptomatic or have mild symptoms, which can lead to a relapse in the number of infections<sup>8</sup>. Thus, treatments should focus on solving the systemic problems, because the good evolution of the patient will depend on minimizing the systemic replication of the virus.

Table 1 - CLASSIFICATION BY CLINICAL MANIFESTS OF COVID-19

<b>Asymptomatic case:</b>
Positive laboratory test for COVID-19 and absence of symptoms.
<b>Light case:</b>
Presence of non-specific symptoms, such as:
- Cough, Sore throat or Runny nose; followed or not by
- Anosmia; Ageusia; Diarrhea; Abdominal pain; Fever; Chills; Myalgia; Fatigue; and/or Headache.
<b>Moderate case:</b>
- Presence of mild signs until progressive worsening; and
- Presence of pneumonia without signs or symptoms of severity.
Mild signs: Persistent cough; Persistent daily fever.
Signs of progressive worsening: Adynamia; Prostration; Hyporexia; Diarrhea.
<b>Serious case:</b>
Severe acute respiratory syndrome (SARS):
- Influenza syndrome with dyspnea/respiratory distress; or
- Persistent chest pressure or SpO <sub>2</sub> (peripheral O <sub>2</sub> saturation) less than 95% on room air; or
- Bluish coloration of the lips or face.
SARS in children:
- Tachypnea
- Hypoxemia;
- Respiratory distress;
- Alteration of the level of consciousness;
- Dehydration;
- Difficulty in eating;
- Myocardial injury;
- Elevation of liver enzymes;
- Coagulation dysfunction;
- Rhabdomyolysis;
- Central cyanosis or SpO <sub>2</sub> < 90-92% at rest and in room air;
- Lethargy;
- Seizures;
- Difficulty in feeding / refusal to feed.
<b>Critical case:</b>
Sepsis;
Septic shock;
Acute respiratory distress syndrome;
Severe respiratory failure;
Multiple organ dysfunction;
Severe pneumonia;
Need for ventilatory support; or,
Intensive care unit admissions.
Ref. <sup>9</sup> .

### 3.2 ADJUVANT TREATMENTS FOR COVID-19

The study of natural methods for the treatment of various pathologies goes back to ancient times. Hippocrates, the Father of Medicine, said that we should make food our medicine. This philosophy was the basis of all ancient Greek medicine and taught that good food is the foundation of health<sup>10</sup>.

ANVISA recommends that foods need to guarantee metabolic and physiological functions to ensure human health<sup>11</sup>. Thus, there is a large amount of foods that produce such beneficial effects and are used

for reducing the risk of diseases such as cancer, diabetes, and intestinal syndromes, as well as for maintaining physical well-being<sup>11</sup>.

Among these foods, coffee and chili peppers stand out, whose active principles are very relevant, with reports on the effects of these active principles in inflammatory, respiratory, and vascular processes, besides working as vitamin, mineral, and amino acid supplements. <sup>10</sup>

Thus, it is believed that the effects that pepper and coffee have on the body can help relieve the symptoms of patients with COVID-19, since they act directly on some complications caused by the disease.

### 3.3 ACTION OF COFFEE AND PEPPER ON THE HUMAN ORGANISM

Pepper and coffee stand out for their actions on the physiological well-being of the human being, thanks to their substances.

Table 2 - DESCRIPTION OF THE SUBSTANCES PRESENT IN COFFEE AND PEP AND THEIR FUNCTIONS IN THE HUMAN ORGANISM.

COFFEE	
SUBSTANCES	FUNCTIONS
Caffeine	Acts on the CNS causing pain relief, especially headaches. Stimulates the dilatation of the airways, improving breathing capacity.
Theophylline	It relaxes the spasms of the smooth muscles, thus improving lung function, since it acts as a bronchodilator.
PEPPER	
SUBSTANCES	FUNCTIONS
Capsaicinoids	It can promote anti-inflammatory actions, besides acting on the CNS causing a feeling of well-being and promoting pain relief.
Carotenoids	They have antioxidant actions, providing a protective action against damage caused by free radicals.
Vitamins A, B1, B2, C, E	They strengthen the immune system; They interact by promoting vasodilation, preventing thrombus formation.

References: 12,13,14,15,16

Chili peppers are considered a functional food for the numerous benefits they cause in the body. Chili peppers have many antioxidant properties and protect our cellular DNA. The presence of the component carotenoids is responsible for providing protective action against the damage caused by free radicals, thus preventing some degenerative diseases. Studies show that about half a tablespoon of pepper

guarantees a large amount of vitamin A, C and E, being able to ensure the maintenance of biological balance<sup>12 13</sup> .

It was also demonstrated that chili peppers have a vasodilating action, due to the presence of vitamins A, C and E, as well as B-complex vitamins, thus avoiding vasoconstriction and the formation of blood clots in the body, reducing the risk of cardiovascular complications, as well as increasing the blood flow and increasing the distribution of O<sub>2</sub> to the tissues. Thanks to the vitamins present, such as vitamin A, chili peppers are also a great ally to the immune system, providing a greater immune resistance to the individual, besides relieving nasal congestion. There is research about its action in non-allergic rhinitis<sup>12</sup> .

Capsaicin, the active ingredient in chili peppers, has a great anti-inflammatory capacity, which can cause pain relief. Evidence of this is the fact that it is used for pain relief in conditions such as diabetic neuropathy, osteoarthritis, among others, since it acts at the central nervous system level, which leads to a sense of well-being<sup>13</sup> .

The chemical composition of coffee is complex, because there are several components that are active in various physiological situations and can act beneficially in the human body. According to the authors, the substances present in coffee can act on the respiratory system, the central nervous system, and the absorption of iron, among other benefits<sup>14</sup> .

According to some studies, it has been noted that coffee drinkers are about 30% less likely to have asthma symptoms than non drinkers, and this effect is proportional to the amount ingested. The substances caffeine and theophylline have also been shown to reduce the fatigue of the respiratory muscles, and also have a bronchodilator effect. In a study carried out with patients who drank coffee and a group who drank a placebo, it was possible to notice that there was an improvement in the pulmonary function of the group that consumed coffee within 2 hours after its consumption<sup>15</sup> .

The substance caffeine also interacts with the central nervous system, causing the relief of headaches. This is because caffeine leads to cerebral vasodilation, and can be found in several drugs, often used to combat headache<sup>14,16</sup> .

Coffee also has an inhibitory action on the absorption of non-haem iron, which is quite relevant, especially for individuals who are anemic or have iron deficiency. It has been possible to observe in some studies that a cup of coffee after a meal can reduce the absorption of non-haem iron by up to 40%, thus eliminating its free radicals. <sup>16</sup>

A recent study led by the team of chemist Nikolai Kuhnert, professor at Jacobs University in Germany, suggested that 5-caffeoylquinic acid was able to inhibit the interaction between the spike protein of the new coronavirus and the ACE-2 receptor present in the human cell, inhibiting the process of virus entry into the cell, and consequently, its entry into the cell. According to the research, a cup of filter coffee would have a sufficient dosage to inhibit the infection. <sup>17</sup>

## 4 CONCLUSION

Evidence suggests an important role of coffee and pepper due to their compounds such as theophylline, caffeine and capsaicin in patients with inflammatory activity, and in those with reduced immunity. With the understanding of the pathophysiological mechanisms of COVID-19, it is believed that these natural substances may impact the evolution of the disease based on their vasodilatory and anti-inflammatory actions, and enhancement in the mechanisms of the immune system in fighting the virus. It is suggested that adding a small amount between 3 and 7 macrogots of red pepper sauce to the contents of a cup of coffee, orally, may bring benefits both in relieving the symptoms of the infected individual with mild to moderate symptoms, and in reducing the likelihood of contracting the new coronavirus infection. But, for this, studies are needed both in vivo, from the follow-up of the clinical evolution of a considerable number of infected patients, and in vitro, to study the cellular actions of the substances.

Therefore, the search for new studies that can better clarify the benefits of natural substances with low cost and easy access for COVID-19 becomes important, in dealing with a disease responsible for a pandemic of long duration and high impact on societies. Thus, this importance also includes mitigating the negative psychosocial and economic impacts that the disease has been causing to the world's population and health systems.

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