

# Usefulness of *Lactococcus lactis* Strain Plasma for Treatment of Allergic Rhinitis: Four Case Reports

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## Abstract

Allergic rhinitis affects many people, especially due to cedar and cypress pollen in spring, for which no effective, reliable, and decisive treatment has been established. Recently, *Lactococcus lactis* strain Plasma, which exhibits immunostimulatory effects and regulates plasmacytoid dendritic cells, has attracted much attention. In this study, we investigated whether *Lactococcus lactis* strain Plasma would be effective against allergic rhinitis. To examine the possible effects, we had 4 volunteer rhinitis patients with allergies to Japanese cedar and cypress who took a drink or supplement containing 100 billion lactobacilli during the pollen season and throughout the year over the 2022 and 2023 seasons. In the 2022 season, 3 patients with mild-to-moderate symptoms no longer required anti-allergic medications. However, 2 required an anti-allergy drug in 2023, and the amount of pollen reportedly scattered was large, even though they took it year-round. The other 2 patients who had been taking *Lactococcus lactis* strain Plasma for the entire year or throughout the pollen season had almost no symptoms. These results suggest that *Lactococcus lactis* strain Plasma could have an auxiliary effect in controlling rhinitis, regardless of the amount of scattered pollen and the patient's immune responsiveness.

**Keywords:** Allergic rhinitis, *Lactococcus lactis* strain Plasma

## INTRODUCTION

Allergic rhinitis (ARh),<sup>1</sup> also known as hay fever, is characterized by mucous inflammation of the nose caused by an overreaction of the immune system during specific times of the year, particularly during spring, as a result of exposure to allergens such as cedar and cypress pollen<sup>2</sup> (Figure 1), flying or suspended in the air. Exposure to allergens results in the generation of allergen-specific T cells and IgE antibodies based on atopic predisposition,<sup>1</sup> but non-ARh<sup>1</sup> has also been noted. Allergic rhinitis affects the greatest number of people, affecting between 10% and 30% of the population in Western countries.<sup>1</sup> Various therapeutic strategies have been tested, including nasal steroids such as fluticasone, antihistamines such as cromolyn sodium, azelastine, leukotriene receptor antagonists,<sup>3</sup> and allergen-specific immunotherapy (AIT).<sup>1</sup> Unfortunately, despite extensive research, no definitive and reliable treatment has yet been found.

Recently, *Lactococcus lactis* strain Plasma (LC-Plasma, JCM5805) was shown to have immunostimulatory effects, inducing the activation of plasmacytoid dendritic cells (pDCs).<sup>4</sup> *Lactococcus lactis* strain Plasma can activate pDCs to express interferons,<sup>4</sup> suggesting induction of a T helper 1 (Th1) immune response to protect against allergic conditions. So far, it can be expected that the responsiveness of dendritic cells (DCs)<sup>4,5</sup> (Figure 1) to environmental allergens in patients with ARh may be reduced, but the involvement of pDCs remains unclear. Four patients with existing cedar-pollen allergic symptoms were asked to take this LC-Plasma bacterium every day in addition to their usual anti-allergic medication, and a significant reduction of the symptoms was observed.

## CASE PRESENTATION

The patients had ARh symptoms due to cedar pollen between the end of February and the beginning of March. The expected effects and safety of LC-Plasma were explained to the patients; subsequently, they drank 500 mL of Japanese tea, black tea, or a sports beverage or took 2 supplement tablets/day containing 100 billion LC-Plasma bacteria (JCM5805) every day, along with the usual oral anti-allergic drug, such as epinastine.

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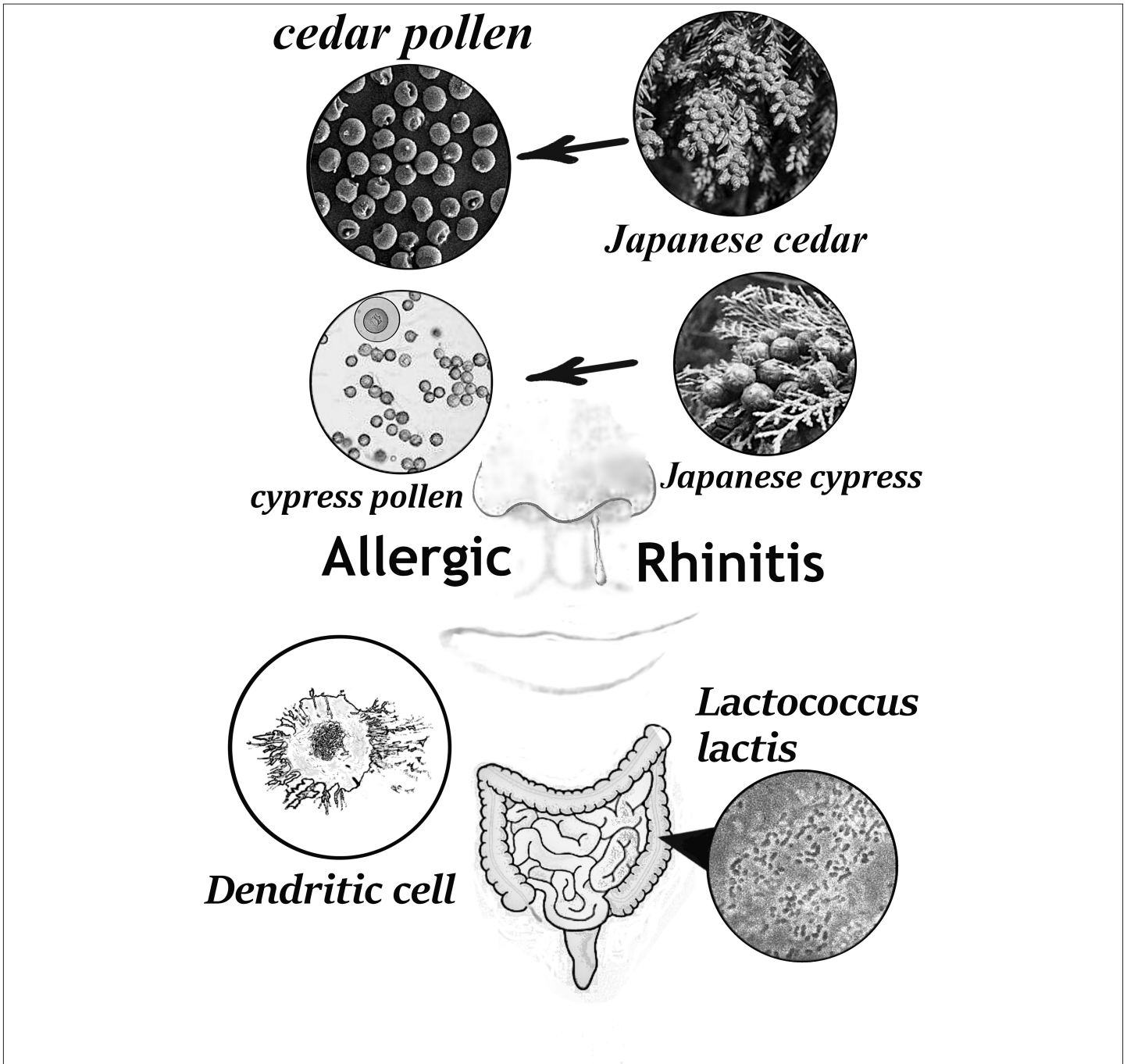
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**Figure 1.** Images of Japanese cedar and cypress and their pollen, which are linked to allergic rhinitis, and *Lactococcus lactis* bacteria, as well as an illustration of LC bacteria-mediated dendritic cell.

### Main Points

- Unfortunately, despite extensive research, no definitive or reliable treatment for allergic rhinitis has yet to be established.
- Very recently, *Lactococcus lactis* strain Plasma (LC-Plasma), which exhibits an immunostimulatory effect, has attracted much attention.
- In 4 patients with mild-to-moderate hay fever, the inhibitory effect of LC-Plasma was confirmed.
- The immunostimulatory response of LC-Plasma was consistent with that of each patient, rather than the amount of scattered pollen.

### Patient 1

A 26-year-old woman presented mild symptoms of hay fever during the cedar pollen season since she was a teenager and occasionally took antihistamines depending on the condition. Her allergic antigen tests (fluorescence enzyme immunoassay) revealed the following results: cedar (3+), cypress (2+), mite (–), and house dust (–). After approximately 2 weeks of drinking LC-Plasma beverages, clear relief of rhinitis symptoms was observed and antihistamines were no longer administered.

The following year, the amount of scattered pollen was large; however, despite the administration of LC-Plasma throughout the year, symptoms appeared and required oral administration of epinastine.

### Patient 2

A 53-year-old woman had rhinitis symptoms during the spring pollen season since she was a child and had been taking anti-allergic drugs such as epinastine daily. Her allergic antigen tests (fluorescence enzyme immunoassay) revealed the following results: cedar (3+), cypress ( $\pm$ ), mite (3+), and house dust (2+). She reported a noticeable relief in the rhinitis symptoms approximately 2 weeks after taking LC-Plasma as compared to that following the usual course of epinastine oral administration alone. She often forgot to take the anti-allergic drugs and reported that she was free of rhinitis symptoms.

The amount of scattered pollen in the Kanto region will reportedly be higher than that for the entire year in the next season of 2023. Despite the administration of LC-Plasma throughout the year, symptoms developed and required oral administration of epinastine.

### Patient 3

A 73-year-old woman experienced symptoms of rhinitis during the cedar pollen season for more than a year as well as facial flushing, which was thought to be caused by pollen. Her allergic antigen tests (fluorescence enzyme immunoassay) revealed the following results: cedar (5+), cypress (2+), ragweed (+), and mite (–). She reported noticeable relief in facial flushing for 1 week despite the use of a corticosteroid ointment, and rhinitis symptoms approximately 2 weeks after taking LC-Plasma.

From the results of that year, she continued to drink LC-Plasma beverages throughout the pollen season, and in 2023, had no symptoms despite a reported high count of scattered pollen. The patient continued to consistently drink the beverage-type LC-Plasma.

### Patient 4

A 43-year-old woman presented symptoms of cedar pollen since she was a teenager and had facial erythema that may be due to pollen. She reportedly avoided rhinitis symptoms with a combination of tranilast and roxithromycin last year.<sup>6</sup> Her allergic antigen tests (fluorescence enzyme immunoassay) revealed the following results: cedar (5+), cypress (1+), orchard grass (–), and mite (–). Although she continued to take LC-Plasma throughout the year, she did not have any rhinitis symptoms, which was believed to be an effect of LC-Plasma.

Although the amount of scattered pollen reportedly varies from year to year, even if the patient is able to respond to pollen, it can have a basic auxiliary effect on mild rhinitis.

## DISCUSSION

Significant improvements were observed in the symptoms by drinking and/or taking LC-Plasma beverages/supplements in 4 patients with ARh in the preliminary study. The mitigating effect of LC-Plasma on ARh symptoms was established by the fact that rhinitis symptoms, although subjective, remarkably improved in the included patients, even if they continued to take anti-allergic agents annually. The involvement and role of DCs and

pDCs in ARh remain unclear; however, Peng et al<sup>5</sup> have reported that activation of pDCs suppresses group 2 innate lymphoid cell function, which are early effectors of mucosal T helper 2 (Th2) immunity. Moreover, continuous intake of LC-Plasma increases T helper 1 response,<sup>7</sup> suggesting suppression of ARh as well as Th2 hypersensitivity disorders, such as atopic dermatitis. Although immunotherapy, such as sublingual or subcutaneous immunotherapy (SCIT),<sup>1</sup> is also widely used, it is not always recommended because of its complexity and expected effects.

Thus, plasma lactic acid bacteria are expected to reduce mild-to-moderate rhinitis and anti-allergic drug use. In patients 1 and 2, the amount of scattered pollen exceeded their ability to respond, and it is believed that they developed symptoms this year and required anti-allergic drugs. These results suggest that the effect of LC-Plasma is influenced by the amount of scattered pollen. However, the individual patient's immune response, recruitment, and responsiveness of pDCs also influence the effect of LC-Plasma, suggesting that the patient's own immune response to this lactic acid bacterium is crucial for this microbe to exert its effect.

**Ethics Committee Approval:** Since LC-Plasma is a food product, the author obtained verbal consent from the patients who participated in this study before administering it, and ethics approval was not applicable.

**Informed Consent:** Verbal informed consent was obtained from the patients who agreed to take part in the study.

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