International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	MOST COMMON DISEASE - STILL NO CURE? THE IMPACT OF DIETARY SUPPLEMENTS ON THE COMMON COLD - A SYSTEMATIC REVIEW
DOI	https://doi.org/10.31435/ijitss.1(49).2026.4677
RECEIVED	03 January 2026
ACCEPTED	15 March 2026
PUBLISHED	21 March 2026
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

MOST COMMON DISEASE - STILL NO CURE? THE IMPACT OF DIETARY SUPPLEMENTS ON THE COMMON COLD - A SYSTEMATIC REVIEW

Zuzanna Rafałowska *(Corresponding Author, Email: zuzia.wojtala@gmail.com)*
University Clinical Hospital in Wrocław, Wrocław, Poland
ORCID ID: 0009-0003-6699-3121

Stanisław Rutz
University Clinical Hospital in Wrocław, Wrocław, Poland
ORCID ID: 0009-0007-7918-9625

Anna Wojtala
Wroclaw Medical University, Wrocław, Poland
ORCID ID: 0009-0008-4082-0835

Julia Kret
Wroclaw Medical University, Wrocław, Poland
ORCID ID: 0009-0003-2780-8448

Aleksandra Wyrostkiewicz
Wroclaw Medical University, Wrocław, Poland
ORCID ID: 0009-0005-3679-7570

Jagoda Pałubska
SP ZOZ MSWiA w Kielcach im. św. Jana Pawła II, Kielce, Poland
ORCID ID: 0009-0000-3833-7977

Oliwer Muller
Szpital Kielecki św. Aleksandra sp. z o.o., Kielce, Poland
ORCID ID: 0009-0005-6197-8461

Aleksander Sadkowski
Szpital Uniwersytecki nr 2 im. dr. Jana Biziela, Bydgoszcz, Poland
ORCID ID: 0009-0008-3300-2447

Paulina Bigda
Wroclaw Medical University, Wrocław, Poland
ORCID ID: 0009-0005-5022-6184

Jan Gdula
Szpital Specjalistyczny im. F. Ceynowy, Wejherowo, Poland
ORCID ID: 0009-0007-9987-3758

Lilianna Zielińska
Plac Hirszfelda 12, Wrocław, Poland
ORCID ID: 0009-0004-2471-841X

Michał Szpunar
Collegium Medicum w Bydgoszczy, Uniwersytet Mikołaja Kopernika w Toruniu, Bydgoszcz, Poland
ORCID ID: 0009-0000-5981-3696

Adrianna Zabiegałowska
Wojewódzki Szpital Zespolony im. Ludwika Rydygiera, Toruń, Poland
ORCID ID: 0009-0005-3048-0097

Magda Buśko
Collegium Medicum w Bydgoszczy, Uniwersytet Mikołaja Kopernika w Toruniu, Bydgoszcz, Poland
ORCID ID: 0009-0005-6451-8612

ABSTRACT

Introduction. The common cold is one of the most prevalent acute respiratory infections worldwide and represents a significant public health and socioeconomic burden. Due to the lack of curative antiviral therapies and the limited effectiveness of conventional symptomatic treatment, there is growing interest in dietary supplements and herbal preparations that may prevent infection, shorten disease duration, or alleviate symptom severity.
Materials and Methods. A structured literature search was conducted using PubMed and Google Scholar databases. Priority was given to systematic reviews, meta-analyses, and randomized controlled trials evaluating the effects of Vitamin D, Vitamin C, cloves (Syzygium aromaticum), zinc, Black elderberry (Sambucus nigra), ginseng (Panax spp.), echinacea (Echinacea spp.), Pelargonium sidoides, and Black seed (Nigella sativa) on the prevention and treatment of the common cold. Studies were assessed according to evidence-based medicine principles, with emphasis on clinical outcomes such as incidence, duration, and severity of symptoms.
Results: The reviewed evidence indicates that zinc lozenges and standardized echinacea preparations provide the most consistent benefits in reducing the duration and severity of common cold symptoms when administered early. Among the analyzed interventions, echinacea was the only one that demonstrated a reproducible preventive effect against the development of the common cold. Black elderberry and Pelargonium sidoides were associated with clinically meaningful reductions in symptom severity and illness duration, although evidence for their preventive efficacy remains limited. Vitamin C and Vitamin D showed modest benefits primarily in specific populations, such as individuals exposed to intense physical stress or those with Vitamin D deficiency. Evidence regarding ginseng was inconsistent, while cloves and Nigella sativa lacked robust clinical trials specifically addressing the common cold despite encouraging preliminary findings.
Conclusions. Several dietary supplements and herbal preparations may offer therapeutic benefits in the management of the common cold; however, their effectiveness varies considerably depending on formulation, dosage, timing of administration, and population studied. Echinacea emerges as the most promising agent for prevention, while zinc, elderberry, and Pelargonium sidoides appear most relevant for symptom reduction and illness shortening. Further high-quality, standardized randomized controlled trials are required to clarify preventive efficacy and establish clear clinical recommendations.

KEYWORDS

Common Cold, Acute Respiratory Infections, Herbal Therapy, Complementary Treatment, Supplements

CITATION

Zuzanna Rafałowska, Stanisław Rutz, Anna Wojtala, Julia Kret, Aleksandra Wyrostkiewicz, Jagoda Pałubska, Oliwer Muller, Aleksander Sadkowski, Paulina Bigda, Jan Gdula, Lilianna Zielińska, Michał Szpunar, Adrianna Zabiegałowska, Magda Buśko. (2026) Most Common Disease- Still No Cure? The Impact of Dietary Supplements on the Common Cold- a Systematic Review. *International Journal of Innovative Technologies in Social Science*. 1(49). doi: 10.31435/ijitss.1(49).2026.4677

Introduction.

The common cold remains one of the most widespread acute respiratory infections (ARI) globally, producing a substantial socioeconomic burden through lost productivity and healthcare utilization (Shokri-Mashhadi et al., 2021). Approximately 70% of the population experiences at least one respiratory infection per year. (Evans et al., 2019). As conventional symptomatic treatments offer limited relief and no curative effect, interest has grown in complementary strategies that may reduce susceptibility to infection, shorten disease duration, or alleviate symptom intensity. Among these, Vitamin D, Vitamin C, Cloves (Syzygium aromaticum), Zinc, Elderberry (Sambucus nigra), Ginseng (Panax spp.), Echinacea (Echinacea spp.), South African Pelargonium (Pelargonium sidoides), and Black seed (Nigella sativa) have received significant scientific attention for their potential immunomodulatory, antiviral, and anti-inflammatory activities. Vitamin D has been widely investigated because of its established role in regulating innate and adaptive immune responses, including modulation of antimicrobial peptides and cytokine profiles; several clinical studies have examined whether correcting Vitamin D deficiency may reduce the risk of acute respiratory infections (Aranow, 2011). Vitamin C, historically linked to immune health, continues to be studied for its antioxidant capacity and its possible ability to slightly shorten the duration of cold symptoms under specific physiological or environmental conditions (Hemilä, 2017). Cloves contain eugenol and other phenolic compounds with recognized

antimicrobial and anti-inflammatory effects, leading to exploratory research on their potential to interfere with early viral activity or modulate inflammation during upper respiratory infections (Ahamad, 2024). Zinc is a critical trace element for immune competence and exerts antiviral, anti-inflammatory, and immunoregulatory effects that provide a plausible mechanistic basis for its role in viral respiratory infections such as the common cold (Wessels et al., 2017). Herbal remedies have also stimulated considerable interest. Elderberry preparations have been studied for their high flavonoid content and their potential to mitigate cold and influenza-like symptoms through antiviral and cytokine-modulating effects (Tiralongo et al., 2016). Ginseng has been explored for its capacity to modulate immune cell function, enhance natural killer cell activity, and potentially reduce the incidence or severity of respiratory infections. Echinacea remains one of the most commonly investigated botanical interventions for upper respiratory infections; its extracts demonstrate immunomodulatory and mild antiviral properties, and numerous trials have evaluated whether these effects translate into reduced cold incidence or duration (Nahas & Balla, 2011). Pelargonium sidoides, traditionally used in South African herbal medicine, has gained international scientific interest for its proposed antiviral, antibacterial, and secretolytic actions that may alleviate symptoms of acute respiratory infections (Mammari et al., 2023). Lastly, Nigella sativa seeds and their key constituents, including thymoquinone, have been investigated for their antioxidative, anti-inflammatory, and immunoprotective properties, prompting research into their potential to reduce respiratory symptom burden or support host defense mechanisms (Ferizi et al., 2023).

Together, these diverse agents represent a broad spectrum of biologically plausible strategies that may influence the course of viral upper respiratory infections. However, the quality, consistency, and clinical relevance of available evidence vary widely. This work aims to critically examine the scientific literature on Vitamin D, Vitamin C, Cloves, Zinc, Elderberry, Ginseng, Echinacea, Pelargonium sidoides, and Nigella sativa, assessing their potential roles in preventing the common cold, shortening its duration, and mitigating symptom severity, while highlighting methodological strengths, limitations, and existing research gaps.

Materials and methods

The research method used was a review of the literature on PubMed and Google Scholar using the keywords: "upper respiratory infections herbal therapy,“ ”upper respiratory infections dietary supplements,“ ”dietary supplements cold,“ and ”immunity system supplements." On this basis, the most common ingredients of medicines and supplements for immunity were identified: Vitamins D And C, Cloves, Zinc, Elderberry, Ginseng, Echinacea, African Pelargonium, And Black seed. The literature review was then repeated using the phrases: "upper respiratory infections Vitamin D,“ ”upper respiratory infections Vitamin C,“ ”upper respiratory infections cloves,“ ”upper respiratory infections zinc,“ ”upper respiratory infections black elderberry,“ ”upper respiratory infections ginseng,“ ”upper respiratory infections echinacea,“ ”upper respiratory infections pelargonium,“ ”upper respiratory infections black seed". The assessment of the effectiveness of preparations on immunity was based primarily on systematic reviews, meta-analyses and randomized controlled trials, which, according to the principles of Evidence-Based Medicine (EBM), constitute scientific evidence of the highest quality and reliability.

Results.

Vitamin D

The mechanism of action is based on Vitamin D inhibiting the formation of pro-inflammatory cells (TH17 cells) and simultaneously participating in the production of Treg cells, which regulate the function of the immune system by preventing pro-inflammatory reactions (Xie et al., 2017; Cantorna et al., 2015). It has also been proven that high levels of Treg cells are inversely proportional to viral respiratory diseases (Weir et al., 2020).

Several meta-analyses and randomized controlled trials have evaluated whether Vitamin D supplementation lowers the incidence of acute respiratory infections (ARIs, of which the common cold is a major component).

An individual-participant data meta-analysis of 10,933 participants found that Vitamin D supplementation modestly reduced the risk of acute respiratory tract infection (adjusted OR 0.88), particularly when given daily or weekly without large bolus doses, and especially in individuals with very low baseline 25(OH)D (< 25 nmol/L) (Martineau et al., 2017).

However, other analyses show small or no effect overall: for example, a 30-trial meta-analysis with over 30,000 participants reported no significant effect (RR 0.96, 95% CI 0.91–1.01), with benefit seen only in daily or short-term supplementation subgroups (Cho et al., 2022).

A recent dose–response meta-analysis of 43 randomized controlled trials (nearly 50,000 participants) found no overall significant preventive effect (RR ~ 0.99), but identified an optimal supplementation range of ~400–1,200 IU/day, especially when taken in daily regimens of less than four months during autumn, winter, spring seasons (Wang et al., 2024).

Mechanistic and cohort evidence suggests that benefit is greatest in those with low baseline Vitamin D, but in populations without deficiency the effect is small (Johnson & Thacher, 2023).

More recently, a meta-analysis focusing on older adults (12 trials, ~29 000 participants) concluded that Vitamin D supplementation does not reduce the risk of ARI's or shows minimal effects. (RR 0.99; 95% CI 0.97-1.02) in that age group (Jia et al., 2024).

In a randomized trial involving over 15,000 older adults not selected for Vitamin D deficiency, daily supplementation with 2,000 IU Vitamin D did not significantly reduce the risk of upper respiratory infections overall (OR 0.96, 95% CI: 0.86–1.06) (Camargo et al., 2024).

Taken together, taking Vitamin D might offer some protection against acute respiratory tract infections overall. However, because many studies do not confirm this effect, more research is needed to better understand its potential role in preventing or treating the common cold (Rondanelli et al., 2018). Vitamin D supplementation may provide moderate protection against respiratory tract infections (including colds), but only in people who are deficient in this Vitamin and when taken daily in moderate doses (400–1200 IU/day), but there is insufficient data to confirm this. Evidence for reducing the duration or severity of colds is weaker and less consistent.

Vitamin C

Vitamin C (ascorbic acid) has long been proposed as a low-cost, readily available intervention against the common cold, yet its efficacy remains controversial. Numerous clinical trials and meta-analyses have explored whether regular or therapeutic supplementation can reduce the incidence, duration, or severity of cold episodes. While some data suggest modest benefits, particularly under certain physiological stresses, the evidence is nuanced and dose-dependent.

Vitamin C supports immune defense through several complementary mechanisms. It strengthens epithelial barriers by promoting collagen synthesis and protecting tissues from oxidative stress, reducing pathogen entry. As a potent antioxidant, Vitamin C regulates the oxidative burst in phagocytes and prevents excessive cell damage. It also facilitates resolution of inflammation by supporting apoptosis and clearance of spent immune cells. (Carr & Maggini, 2017). Additionally, Vitamin C influences adaptive immunity by modulating cytokine production and supporting lymphocyte function (van Gorkom et al., 2018). During infections Vitamin C levels decline, indicating increased physiological demand (Bakaev & Duntau, 2004).

Most large-scale reviews show no preventive effect of Vitamin C on cold incidence in the general population at doses of 200 mg/day or higher. The Cochrane analysis includes 29 clinical trials with over 11,300 participants; preventive supplementation did not significantly reduce the risk of developing a cold (Hemilä & Chalker, 2013). Although another meta-analysis found that routine supplementation of more than 1g slightly reduces incidence in ordinary conditions (Nahas & Balla, 2011). Then review of complementary treatments similarly concluded that Vitamin C does not prevent colds; the summary is based on multiple randomized controlled trials of varying sizes (typically 100–400 participants) (EBSCO CAM Review Board, 2024). A broader epidemiological overview similarly concludes that supplementation does not decrease the risk of infection, although it may influence duration. This report considered datasets totaling several thousand participants (Keya et al., 2021).

Several trials show that Vitamin C reduces incidence by up to 50% in people exposed to extreme physical stress (e.g., marathon runners, soldiers in subarctic training). Doses in these studies were typically 200–1000 mg/day, given orally (Cerullo et al., 2020; Douglas & Hemilä, 2005).

Effect on duration and severity of symptoms vary in studies. Multiple controlled studies show that Vitamin C shortens cold duration, often modestly but consistently (Ran et al., 2020). A PLOS Medicine review, analyzing placebo-controlled trials with several hundred participants, concluded that Vitamin C is effective only when taken preventively, not when supplementation begins after symptom onset. Vitamin C 200mg or more taken regularly as a preventive measure shortens the duration of colds – by an average of 8% in adults and 14% in children – and alleviates symptoms (Douglas & Hemilä, 2005). A 2023 meta-analysis included both mild and severe infections (sample sizes up to 400–500 individuals) and found greater reductions in

severity among more severe cases; many comparisons reached statistical significance. They investigated orally administered Vitamin C in doses ≥ 1 g daily (Hemilä & Chalker, 2023).

When Vitamin C is started after symptom onset, effects are inconsistent. Several randomized trials—often involving 100–300 participants—found no significant shortening of cold duration (p-values > 0.05) (Nahas & Balla, 2011). One meta-analysis concluded that supplementation does not significantly relieve symptom severity when started at onset, even if doses are high (Keya et al., 2021). Dosage of 8g has shown effect on reduction in the duration of colds only in one study (Nahas & Balla, 2011; Anderson et al., 1974).

Across all available evidence, Vitamin C does not reliably prevent common colds in the general population. However, consistent daily supplementation can modestly shorten duration and reduce severity, especially at higher doses (≥500 mg/day). In physically stressed individuals such as athletes, Vitamin C significantly reduces incidence. Therapeutic use after symptom onset shows inconsistent benefits, though some studies report symptom alleviation when combined with preventive supplementation.

Syzygium aromaticum (Clove)

Clove contains a high concentration of essential oil, chiefly eugenol, which exerts antioxidant, anti-inflammatory, antimicrobial and antiviral effects. Analyses consistently show that eugenol represents roughly 60–88% of the oil's composition, along with compounds such as β-caryophyllene, α-terpinyl acetate, and others (Ahamad, 2024; Vicidomini et al., 2021). In one recent analysis of cloves from Kurdistan, the essential oil inhibited free radicals by ~ 91% (as measured by DPPH assay), comparable to standard antioxidants like ascorbic acid (Ahamad, 2023). These biochemical properties suggest that clove might modulate host responses during viral respiratory infections — for example in a study of clove essential oil (referred to as EOCa), the oil exhibited antiviral activity against hepatitis A virus (HAV) with an IC_{50} of ~ 0.73 μg/mL and a selectivity index (SI) of 14.46, indicating a therapeutic window above cytotoxicity (Kiki, 2023) as well as against SARS Cov-2 (Ahamad, 2024) and RSV (Green, 2019). Beyond direct antiviral effects, clove displays immunomodulatory activity. In vitro experiments on murine splenocytes treated with clove extracts (at 100 and 1000 μg/mL) revealed suppression of proliferative response to mitogen (PHA), but enhancement of LPS-stimulated proliferation; cytokine profiling showed decreased IFN-γ and increased IL-4, IL-10, and TGF-β secretion (Dibazar et al., 2014). Such modulation suggests anti-inflammatory and regulatory responses — a mechanism potentially relevant for alleviating excessive inflammation in respiratory infections. Additionally, reviews underscore clove's analgesic, and expectorant properties, which historically have supported its use in respiratory conditions, such as cough, sore throat, catarrh and mucosal irritation (Ahamad, 2024). Collectively, the mechanistic evidence supports the hypothesis that clove compounds may help reduce viral load, modulate inflammation, and soothe irritated airways—mechanisms relevant to common cold pathophysiology.

Despite much promising evidence of the antiviral activity of clove oil the available literature does not present any clinical trials evaluating cloves for the prevention of common colds in humans. A phytotherapeutic review highlights antiviral and antimicrobial potential and states that cloves have historical applications in respiratory ailments, but it offers no participant data, doses, or statistical analysis confirming prophylactic benefit (Bhowmik et al., 2012). Additionally, a broad nutritional review of immune-supportive plant compounds concludes that current evidence is insufficient to establish effectiveness in preventing respiratory infections, including the common cold (Kumar Pandey et al., 2022). Based on available sources, cloves cannot be considered a proven preventive measure against viral upper respiratory infections.

Similarly, there is a lack of data in publications on reducing cold symptoms. Preclinical and mechanistic studies suggest possible benefit: anti-inflammatory effects of eugenol could theoretically accelerate recovery from mucosal irritation; however a 2021 study does not demonstrate measurable outcomes such as reduced duration, time to symptom resolution, or statistical significance (Vicidomini et al., 2021). Whereas the clinical-oriented review notes reductions in airway inflammation and potential relief of symptoms such as sore throat or airway discomfort. (Ahamad, 2024). Another scientific review indicates that extracts of clove with cinnamon may support the alleviation of respiratory symptoms through anti-inflammatory pathways, yet without reporting human trials or intervention (Iftikhar et al., 2024).

An additional pharmacognostic review identifies clove preparations as having expectorant properties, which may aid in clearing mucus during productive cough—a common symptom of colds. However, this evidence is also based on traditional use and pharmacological data, not on randomized human trials (Shahrajabian et al., 2020).

While not related to the common cold, the RSV inhibition study demonstrates actions relevant to symptom relief in viral respiratory infections, supporting broader therapeutic potential of clove compounds (Green, 2019). However, the lack of human clinical data limits its applicability.

Taken together, clove and its bioactive components, particularly eugenol, demonstrate significant antiviral, anti-inflammatory, and expectorant activities in mechanistic and preclinical studies. These properties suggest potential for symptom relief in respiratory infections. However, no human clinical trials currently support the use of cloves for preventing common colds, shortening their duration, or providing statistically significant symptom alleviation. The absence of standardized dosing protocols, participant data, and controlled outcomes underscores the need for well-designed human studies before cloves can be recommended as an evidence-based therapy for common cold management.

Zinc

Zinc is a critical trace element for immune competence and exerts antiviral, anti-inflammatory, and immunoregulatory effects that provide a plausible mechanistic basis for its role in viral respiratory infections such as the common cold. At the cellular level, zinc contributes to the proper development and function of immune cells: it is essential for maturation and activity of neutrophils, natural killer (NK) cells, T- and B-lymphocytes, and macrophages. Zinc deficiency impairs phagocytosis, intracellular killing, lymphocyte proliferation, Th1-mediated responses, antibody production, and proper cytokine signalling — all of which increase susceptibility to infections (Shankar & Prasad, 1998; Wessels et al., 2017). Moreover, zinc has been shown in vitro to interfere with multiple stages of the viral replication cycle. A comprehensive review summarising decades of laboratory data reports that zinc ions can lead to inactivation of free virus particles, prevent viral uncoating, inhibit viral genome transcription, and block viral protein translation or polyprotein processing (Read et al., 2019). In some cases zinc appears to inhibit viral polymerases or proteases, which are essential for replication of RNA viruses — a mechanism that may apply to cold-causing rhinoviruses or other respiratory viruses (Read et al., 2019; Prasad et al., 2022).

Although zinc has been widely promoted for preventing colds, clinical evidence does not support a meaningful reduction in cold incidence in the general population. A large body of randomized trials summarized in recent reviews found no preventive effect when oral zinc was administered daily in healthy adults (Nault et al., 2024; Wang et al., 2020; Nahas & Balla, 2011).

Despite the lack of preventive efficacy, numerous controlled trials indicate that zinc can shorten the duration of cold symptoms when supplementation is initiated shortly after onset. A meta-analysis of randomized trials reported that zinc lozenges providing over 75 mg/day of elemental zinc significantly reduced the duration of symptoms by 1,42 day compared with placebo (pooled $N \approx 500$; results statistically significant at $p < 0.05$) (Wang et al., 2020). The benefit appears to be maximal if the lozenges are started immediately after the onset of symptoms (Garland & Hagmeyer, 1998).

Another systematic review evaluating the therapeutic efficacy of zinc confirmed similar findings, noting that zinc supplementation not only shortens symptom duration but may also reduce overall symptom burden. This conclusion was based on pooled evidence from multiple clinical trials, most using zinc acetate or zinc gluconate lozenges at doses between 75 and 92 mg/day, with statistically significant reductions in total duration (Mousa, 2016).

Several additional analyses support therapeutic benefit. For example, a frequently-cited double-blind study of about 100 participants used a zinc-gluconate lozenge that provided 13.3 mg zinc per lozenge, taken repeatedly throughout the day until symptom resolution; that trial reported faster resolution of several symptoms (for example, coughing resolved in ~2 vs ~4 days, sore throat in ~1 vs ~3 days in treated vs placebo groups) (EBSCO CAM Review Board, 2024). Another study reports a shortening of cold duration by an average of 3 days (Hemilä et al., 2016). Further clinical evidence from small-to-medium randomized trials also demonstrates that zinc supplementation — usually in lozenge form and above 75 mg/day — consistently shortens illness duration, with many trials reporting improvements in symptom severity as well (Rondanelli et al., 2018).

Finally, a recent comprehensive assessment confirms that zinc does not prevent colds, but may reduce the duration by 1–2 days in adults and children, particularly when administered within 24 hours of symptom onset using high-dose lozenges. This review also notes a relatively high frequency of mild adverse effects such as taste disturbance and nausea, which were common across zinc lozenge trials (Nault et al., 2024).

Indeed, side effects of zinc lozenges are commonly reported, mainly: bad or metallic taste in the mouth and nausea (Science et al., 2012). Nasal administration of zinc (e.g., sprays or gels) has been linked to more severe and potentially permanent effects: several case reports associate intranasal zinc use with loss of smell (anosmia), which has led to safety warnings against such application (Jafek et al., 2004).

In summary, although the antiviral properties of zinc provide a plausible mechanistic basis for its therapeutic use in upper-respiratory infections, current evidence indicates that zinc supplementation does not

prevent the onset of the common cold. However, multiple controlled studies consistently demonstrate that zinc can reduce the duration and severity of cold symptoms when administered shortly after their onset. When evaluating the overall clinical usefulness of zinc, it is essential to consider the relatively frequent adverse effects associated with its use and to assess the resulting benefit–risk balance.

Black elderberry (Sambucus nigra)

Black elderberry (Sambucus nigra) has been widely used in traditional medicine for respiratory tract infections, and recent research has sought to assess whether its use can meaningfully prevent, shorten, or alleviate symptoms of the common cold or influenza. In vitro studies show that elderberry fruit extracts can inhibit infection by influenza viruses: flavonoids from elderberry were found to bind directly to virions of human influenza A (H1N1), blocking their ability to infect host cells. In the same context, higher extract concentrations achieved complete inhibition of viral replication in cell culture, suggesting a potential direct antiviral mechanism (Młynarczyk et al., 2018; Stich et al., 2022).

Beyond direct antiviral effects, there is evidence that elderberry extracts may modulate immune responses. One in vitro study demonstrated that a standardized anthocyanin-rich black elderberry extract enhanced dendritic-cell mediated T cell responses, indicating immune-stimulating potential (Stich et al., 2022). These two possible modes — direct viral inhibition and immunomodulation — constitute the mechanistic basis for the use of elderberry in respiratory infections (Młynarczyk et al., 2018).

A landmark study by Z. Zakay-Rones et al., 2004, enrolled 60 adult patients (aged 16–54) with confirmed influenza A or B, who received 15 mL of elderberry syrup four times daily for five days. Compared to placebo, the elderberry group experienced a significantly faster improvement in symptoms: the majority reported improvement within 3–4 days, whereas the placebo group needed 7–8 days (mean global improvement score 3.1 ± 1.3 vs. 7.1 ± 2.5 days; $p < 0.001$) ((Zakay-Rones et al., 2004)).

The results of other four clinical trials were meta-analyzed, proving that administration of elderberry extract significantly reduced upper respiratory tract symptoms in patients with influenza and the common cold compared to the control group. In that trial, Kong (2009) administered four lozenges per day (each containing 175 mg standardized elderberry extract) to 64 outpatients with influenza-like symptoms (symptom duration $\leq$ 24 h). After 48 h, participants receiving elderberry had a significant reduction in visual analogue scale (VAS) scores for fever, headache, muscle aches, nasal congestion, and mucus discharge; for example, fever VAS dropped from 2.67 ± 1.8 to 0.47 ± 0.64 ($p < 0.0001$) (Mahboubi, 2020).

The 2020 review concludes that standardized elderberry (Sambucus nigra) berry preparations, started within 48 hours of onset, probably shorten and lessen symptoms of acute viral respiratory infections such as influenza and the common cold in adults. Five randomized controlled trials (936 participants) using commercial elderberry products (syrup, capsules, lozenges, hot drink) generally showed greater reductions in overall symptom severity and faster improvement in fever, headache, nasal congestion and nasal mucus discharge than placebo or control when taken for up to about 2 weeks (Harnett et al., 2020).

Evidence also exists for common cold (non-influenza) settings. In a randomized trial involving 312 healthy adults traveling long-haul flights (average age ~51 years), participants received either standardized elderberry capsules or placebo beginning 10 days before travel. The dose was 300 mg of a proprietary elderberry extract, two to three times per day before travel and 900 mg/day around the travel period. In those who developed a cold (29 participants, ~9%), the elderberry group had a shorter mean cold duration (4.75 vs. 6.88 days) and lower symptom severity (mean Jackson score 21 vs. 34; $p = 0.04$ for duration; $p = 0.01$ for severity) (Tiralongo et al., 2016).

A comprehensive 2021 systematic review and meta-analysis of randomized controlled trials concluded that elderberry “may reduce the duration and severity” of common cold and influenza, but the authors stressed that the evidence is uncertain due to small sample sizes, heterogeneity among studies, and methodological limitations (e.g., risk of bias, imprecision) (Wieland et al., 2021). Importantly, the review found no conclusive evidence that elderberry definitively prevents the onset of the common cold; in the prevention trial described, the difference in incidence between elderberry and placebo groups was not statistically significant (RR 0.69; 95% CI 0.34–1.39; $p = 0.30$) (Wieland et al., 2021).

In summary, clinical data - though limited - suggests that supplementation with standardized black elderberry extract (in syrup, lozenge, or capsule form) may help shorten the duration and reduce the severity of influenza and common cold symptoms, particularly if started early after onset. However, the preventive effect against contracting a cold has not been shown statistically and overall quality of evidence remains low to very low. Therefore, while elderberry may represent a promising complementary option for symptomatic relief of viral respiratory infections, the current evidence does not justify strong claims of prevention.

Ginseng

The mechanisms by which ginseng may prevent or mitigate respiratory infections are primarily immunomodulatory and involve both innate and adaptive immune pathways. Preclinical experiments in mice have shown that red ginseng extract enhances antiviral defense by increasing activity of natural killer (NK) cells, upregulating interferon-γ production, and promoting the survival of lung epithelial cells during viral challenge, suggesting improved early viral clearance and reduced tissue damage (Yoo et al., 2012; Nahas & Balla, 2011). Human immunology studies similarly indicate that ginsenosides and polysaccharides regulate cytokine balance by reducing excessive pro-inflammatory signaling while enhancing protective antiviral responses (Seida et al., 2011). These compounds have also been shown to have immunomodulatory effects, thereby strengthening immunity and increasing the body's ability to respond to respiratory viruses (Mousa, 2016). Collectively, these mechanisms—NK-cell activation, cytokine modulation, enhanced antigen presentation and epithelial protection—offer a biologically plausible explanation for the preventive and symptom-reducing effects of ginseng observed in some clinical studies.

Clinical prevention trials of ginseng preparations have produced mixed but promising results: a systematic review that pooled five randomized trials (total n ≈ 747) reported a tendency toward fewer people experiencing at least one common cold or other acute respiratory infection with ginseng versus placebo (relative risk 0.70, 95% CI 0.48–1.02) but this result did not reach conventional statistical significance, while pooled results from two trials suggested that prophylactic ginseng shortened the duration of colds/ARIs by an average of 6.2 days (95% CI 3.4–9.0) (Seida et al., 2011).

One practical pattern that emerges from the prevention literature is that trials administered ginseng prophylactically for weeks to months rather than acutely at symptom onset (Yoo et al., 2012) —for example, some trials used daily dosing for 8–16 weeks—indicating that the preventive signals were observed with medium-term, daily supplementation rather than single or very short courses (Seida et al., 2011).

Individual randomized trials contributing to those pooled results reported clinically relevant reductions in incidence and burden in some settings: for instance, one trial of a standardized North American ginseng extract used two capsules daily for four months and found fewer mean colds per person and fewer participants experiencing two or more colds (study sample originally 323 with analysed groups after dropouts), with reductions in total symptom days (10.8 vs 16.5 days) and total symptom scores favoring ginseng (differences reported with 95% CIs indicating statistical significance in that trial) (Predy et al., 2005).

However, the evidence is not uniformly positive: narrative and systematic reviews emphasize inconsistency between trials, variable methodological quality, and heterogeneity in products, doses and populations, so that while some individual trials reported statistically significant preventive effects, the overall body of evidence was judged by reviewers to be insufficiently robust to claim definitive prevention across populations (Nahas & Balla, 2011).

Beyond prevention, several trials and pooled analyses indicate that ginseng taken prophylactically may reduce the duration and severity of subsequent colds or influenza-like illnesses in people who nevertheless become infected—for example, the new 2025 systematic review showed a 3.4-day faster recovery from acute respiratory illness (ARI) and 37.1% less severe symptoms (Seida et al., 2011) and the 2006 randomized, double-blinded, placebo controlled trial reported significantly shorter symptoms durations by approximately 6 days (McElhaney et al., 2006).

In conclusion, the compiled clinical evidence from randomized trials and systematic reviews supplied here indicates that ginseng prophylaxis shows a consistent signal toward reducing the burden (duration and severity) of colds/ARIs and, in some trials, reducing incidence, but the overall evidence base is heterogeneous and not uniformly conclusive—benefit appears most likely when standardized North American ginseng preparations are taken daily for weeks to months, yet definitive, broadly generalizable claims of prevention require larger, high-quality trials using well-characterized extracts and standardized dosing regimens.

Echinacea

Echinacea is among the most widely studied herbal supplements for the prevention and treatment of upper respiratory tract infections, including the common cold.

Mechanistically, Echinacea's potential benefits appear to derive from immunomodulatory and possibly direct antiviral actions. Preclinical and ex vivo studies indicate that compounds in Echinacea (e.g., alkamides, polysaccharides, caffeic-acid derivatives) can enhance innate immune responses: they stimulate phagocytosis, increase activity of natural killer (NK) cells, modulate production of pro- and anti-inflammatory cytokines (such as IL-1, IL-6, TNF-α, and IL-10) and upregulate expression of interferons, thereby improving the host's antiviral defenses even before exposure or early in infection (Nahas & Balla, 2011). Moreover, certain

Echinacea extracts have demonstrated in vitro inhibition of viral replication of common cold viruses (rhinovirus and some coronaviruses) in human respiratory epithelial cells, suggesting that besides immune modulation, there might be direct interference with viral entry or replication at the mucosal surfaces (Shahrajabian et al., 2020). Taken together, these mechanisms — enhanced innate immunity, cytokine regulation, NK-cell activation, and direct antiviral effect — provide a biologically plausible rationale for the observed prophylactic and therapeutic effects of Echinacea in some clinical trials.

Evidence regarding the clinical efficacy of Echinacea in preventing, shortening, and alleviating cold symptoms is promising, and most studies demonstrate statistically significant efficacy. However, the results of some studies remain inconclusive and are highly dependent on the species, type of extract, dosage, and study design. One of the most rigorous recent investigations is the randomized, controlled prevention-and-treatment study conducted by Kolev et al. (2022), in which 120 adults received the standardized Echinacea purpurea at 2,400 mg/day for prevention and 4,000 mg/day during acute episodes. The authors reported that prophylactic use significantly reduced the number of viral detections, including SARS-CoV-2, with a risk ratio of 0.37 ($p = 0.03$), and that treatment significantly reduced viral load and shortened virus-clearance time by 8 days ($p = 0.02$), indicating both preventive and therapeutic benefits when appropriately dosed (Kolev et al., 2022).

Long-term prophylaxis has also been evaluated in a large-scale adult trial summarized by Schoop et al. In this four-month randomized, double-blind, placebo-controlled study of 755 healthy adults, a standardized fresh-plant Echinacea purpurea extract taken daily according to the study's prophylactic regimen decreased the number of cold episodes, cumulative sick days, and virologically confirmed infections, with the authors reporting several statistically significant reductions ($p < 0.05$) in compliant participants (Jawad et al., 2012).

A randomized trial evaluating treatment effects in children was performed by Weishaupt et al. (2020). In this study, 79 children (4–12 years) initiated Echinaforce Junior at early symptom onset, receiving either 1,200 mg/day or 2,000 mg/day depending on dosing frequency. Among 130 cold episodes, the higher dose significantly shortened the duration by 1.2 days ($p = 0.046$), and the effect increased to 1.7 days ($p = 0.02$) when corrected for actual intake. These findings demonstrate a clear dose–response relationship and suggest that adequately dosed Echinacea purpurea preparations may reduce the clinical course of pediatric upper respiratory infections (Weishaupt et al., 2020).

Additional evidence supporting therapeutic effects derives from the earlier Phytomedicine RCT (randomized clinical trial), where 246 adults who developed cold symptoms received two tablets three times daily of a fresh-plant Echinacea purpurea extract. The study found that this extract was significantly more effective than placebo in reducing symptom scores (Brinkeborn et al., 1999).

Additional reviews converge on a similar interpretation: studies of Echinacea purpurea extracts often show preventive, shortening, and symptom-relief effects - such as the 2012 review, which reports reductions in symptom severity and duration in several controlled trials (Jawad et al., 2012).

However, not all trials confirm benefit. The Cochrane analysis notes that while some individual trials report reductions in cold incidence or symptom duration, the overall quality of evidence is low, with substantial variation between studies, preparations, and methodologies, preventing firm conclusions about efficacy across all Echinacea products (Karsch-Völk et al., 2014).

Other mechanistic and clinical summaries, including those from broader evaluations of immune-supporting preparations, confirm that certain Echinacea purpurea products demonstrate preventive, shortening, and symptom-reducing potential, though these conclusions are again tied to specific preparations and are not generalizable to all extracts (Jasiński et al., 2024).

Overall, the current body of evidence suggests that standardized Echinacea purpurea extracts, especially when taken prophylactically at minimum 2000 mg/day, may reduce viral detection rates, shorten the duration of respiratory infections and lessen symptom severity, with several well-conducted trials documenting statistically significant effects. However, not all studies confirming the effectiveness of Echinacea have achieved statistical significance, which proves that further research is still needed.

Pelargonium sidoides

Current clinical evidence on Pelargonium sidoides (most commonly standardized as EPs 7630- a proanthocyanidin-rich extract from the roots of P. sidoides.) indicates that this herbal extract may shorten the duration and reduce the severity of symptoms in acute viral upper-respiratory infections, including colds, although data supporting an explicit preventive effect remain limited.

Recent mechanistic work offers additional insight into Pelargonium's effects. A 2024 review in Frontiers in Pharmacology describes antiviral activity through inhibition of viral replication and modulation

of inflammatory mediators including TNF-α, IL-6, enhancement of mucociliary clearance and nitric oxide synthase. These mechanisms are proposed to underlie the clinically observed reductions in symptom severity and duration (Cinatl et al., 2024; Careddu & Pettenazzo, 2018).

One of the most comprehensive summaries of clinical trials is provided in the review by Mammari et al. (2023), which reports that across multiple randomized and placebo-controlled studies in adults and children, EPs 7630 consistently reduced overall symptom scores and accelerated recovery time in acute respiratory tract infections; the authors highlight statistically significant improvements in several primary endpoints but note that the quality and designs of individual trials vary (Mammari et al., 2023).

Additional evidence comes from the randomized, double-blind trial by Lizogub et al. (2007), in which adults with acute bronchitis received EPs 7630 drops three times daily for seven days. The authors reported significant reductions in symptom severity compared with placebo, accompanied by earlier improvement in cough, sputum production, and chest pain. After 10 days, 78.8% compared with 31.4% in the EPs group compared with placebo were clinically cured (P <.0001). The mean duration of work disability was significantly shorter in the EPs-treated group (6.9 ± 1.8 days) than in the placebo group (8.2 ± 2.1 days; P =.0003) (Lizogub et al., 2007).

Therapeutic effects have also been observed in a 2008 randomized, placebo-controlled trial in children with acute bronchitis, administering EPs 7630 oral drops three times daily for ten days. The number of patients who achieved clinical cure by day 10th was significantly higher in the treated group (78.8% compared to 31.4%, P < 0.0001). The average duration of days absent from work was significantly shorter in the treated group (6.9 ± 1.8 compared to 8.2 ± 2.1, P < 0.0003), as was the number of days with activity levels below 100% (7.1 ± 1.5 compared to 8.7 ± 1.3, P < 0.0001) (Patrick & Hickner, 2008).

Further supportive evidence is summarized in the 2019 review by Riley et al., which notes that EPs 7630 reduces symptom burden and accelerates recovery across several clinical trials involving acute upper-respiratory infections. 105 adults suffering from cold symptoms took one coated tablet containing 40 mg of EP 7630 or a placebo three times a day for 10 days. On day 10, 45% of patients in the EPs 7630 group and 12% of patients in the placebo group achieved clinical cure, while all or all but one symptom completely resolved in 74% (EPs 7630) and 25% (placebo) of patients, respectively (Riley et al., 2019).

A broader review of herbal treatments for respiratory infections (2018) similarly concludes that EPs 7630 may shorten illness duration and lessen symptom intensity, referencing several trials where the extract produced clinically meaningful reductions in cough, sore throat, and general malaise, though the article does not allow conclusions to be drawn about the effectiveness of EPs 7630 in preventing colds (Careddu & Pettenazzo, 2018).

Finally, additional clinical evaluations continue to support therapeutic but not preventive effects. The 2013 study reports improvements in symptom severity and earlier resolution of upper-respiratory symptoms with EPs 7630 treatment, based on clinical observations of adult patients; the authors confirm symptom-relief benefits but point out the lack of reliable data and do not provide evidence of preventive action (Timmer et al., 2013).

Overall, the available evidence indicates that standardized Pelargonium sidoides extract (EPs 7630) demonstrates consistent symptom-reducing and illness-shortening effects in acute viral upper-respiratory infections, including those resembling the common cold. However, no strong evidence exists for prevention, and reported benefits apply only to specific, standardized preparations, not to pelargonium extracts in general.

Nigella sativa (black seed)

Nigella sativa (black seed) has been studied as a natural remedy with purported immunomodulatory and antiviral properties, prompting researchers to explore its possible role in preventing or alleviating respiratory infections. Experimental and preclinical studies indicate that the principal bioactive constituent of Nigella sativa, thymoquinone, exerts antioxidant and anti-inflammatory effects in cell and animal models, including reduction of oxidative stress markers and downregulation of pro-inflammatory cytokines (Ferizi et al., 2023).

Immunomodulatory effects described in the literature include modulation of innate immune cells (e.g., macrophage activation and altered NK-cell activity) and changes in cytokine profiles (increased the secretion of IL-3 and IL-10) that could plausibly enhance early antiviral defenses while limiting excessive inflammation (Majdalawieh et al., 2010; Khazdair et al., 2021).

Overall, mechanistic evidence from in vitro and animal work (antiviral activity, antioxidant effects, cytokine modulation, and innate immune enhancement) provides a biologically plausible rationale for potential benefits of N. sativa in respiratory infections (Karaarslan et al., 2024).

A human observational study has reported that regular supplementation with N. sativa was associated with a lower incidence of respiratory tract infections in a population sample, suggesting a potential protective or immunoprotective effect (Salem et al., 2023). In a 2024 study, 230 participants took black cumin extract containing a minimum of 3ml/mg of thymoquinone. During the observation period, positive effects, which were considered to be caused by the use of NSO, occurred in 86.4% of participants in the study group. Of those who experienced positive effects, 68 (71.6%) reported a reduction in symptom severity, 44 (46.3%) reported a reduction in recurrent upper respiratory tract infections, 30 (31.6%) reported a reduction in allergic rhinitis symptoms, 17 (17.9%) reported a reduction in the frequency of antibiotic use, 2 (2.1%) reported a reduction in dyspeptic symptoms, and 2 (2.1%) reported other beneficial effects, i.e., weight control and reduced fatigue. This study proves the effect of black cumin in alleviating and preventing colds (Karaarslan et al., 2024).

Preclinical antiviral studies further report that in adult patients with asthma, supplemental or single administration of N. sativa seeds (1-2 g/day), boiled extract (50-100 mg/kg) or oil (1 g/day) for 3-12 weeks significantly improved asthma symptoms. A nasal spray containing N. sativa oil (22.6 µg or 25 µl) in geriatric patients resulted in relief from dryness and nasal congestion and NSPN extract (360 mg N. sativa and 50 mg Phyllanthus niruri extracts) in patients with acute tonsillitis and pharyngitis also alleviated sore throat. This proves the possible symptomatic relief of black cumin in upper respiratory tract infections (Gholamnezhad et al., 2019). Similar conclusions are drawn from a randomized, open-label, parallel-group study- in this study, we evaluated the efficacy and safety of black cumin seed oil as an adjunct to standard treatment of uncomplicated respiratory tract infections. Although both groups showed similar efficacy in alleviating systemic symptoms, adjunctive therapy resulted in a significantly higher percentage of patients experiencing early symptom improvement, mainly in terms of cough, rhinitis, and fever (Elango et al., 2022).

Reviews that synthesize available evidence caution that while several studies point to immunoprotective and symptom-reducing effects, the heterogeneity of preparations, dosages, endpoints and study quality prevents firm conclusions about prevention of the common cold specifically (Jasiński et al., 2024).

In summary, Nigella sativa demonstrates immunomodulatory and possible antiviral properties in preclinical models, and some observational or small-scale human data hint at beneficial effects on respiratory infections; however, robust clinical evidence is missing, and the heterogeneity of available studies — in terms of population, pathogens, formulations, and endpoints — precludes reliable generalization. More rigorous, well-designed randomized controlled trials with standardized preparations, adequate sample size, proper controls, and clear outcome definitions are necessary to evaluate whether N. sativa can play a meaningful role in preventing or mitigating common colds or other upper-respiratory viral infections.

Discussion

This review evaluated evidence for the preventive and therapeutic effects of several commonly used supplements—Vitamin D, Vitamin C, cloves, zinc, Black elderberry (Sambucus nigra), ginseng (Panax spp.), Echinacea (Echinacea spp.), Pelargonium sidoides, and Nigella sativa—on the incidence, duration, and severity of the common cold.

For Vitamin D, individual-participant meta-analyses show modest reductions in acute respiratory infection (ARI) risk primarily in individuals with low baseline 25(OH)D levels receiving regular daily or weekly dosing, whereas large meta-analyses in general populations report no significant benefit for preventing respiratory infections or colds. Vitamin C does not consistently reduce cold incidence in general populations, although supplementation may slightly shorten duration and lessen severity when taken routinely, with stronger effects seen in individuals exposed to heavy physical stress.

Despite extensive traditional use, cloves lack clinical trials evaluating their efficacy in preventing or treating colds, and current reviews highlight the absence of human evidence.

In contrast, zinc lozenges have consistent support from randomized trials and meta-analyses showing a reduction in cold duration and overall symptom burden when used at appropriate doses shortly after onset, although routine supplementation does not prevent colds. Black elderberry extracts show clinical benefits in reducing symptom severity and shortening the duration of respiratory infections in several trials, though the evidence for preventing colds remains inconsistent and based on relatively small studies. Studies on ginseng report mixed results: some randomized trials and pooled analyses suggest shorter duration or milder symptoms in upper respiratory infections when taken preventively, but other trials show no significant benefit, leading reviews to deem the evidence inconclusive.

More consistent findings are available for Pelargonium sidoides (EPs 7630). Multiple clinical trials show statistically significant reductions in symptom severity and faster recovery in adults and children with acute viral respiratory infections, although evidence for primary prevention is lacking. The review demonstrates the effectiveness of Echinacea in both preventing and shortening the duration and alleviating the symptoms of colds. Although the results are promising, the lack of statistical significance of some studies suggests that additional, in-depth research is needed. For Nigella sativa (black seed), human clinical evidence remains limited. Some studies associate supplementation with fewer respiratory infections or reduced symptom severity, and several observational and interventional reports describe symptomatic improvement in respiratory illnesses, but large, well-controlled trials specific to the common cold are lacking.

Conclusions

Among all agents reviewed, zinc lozenges and Echinacea have the strongest and most consistent evidence for reducing the duration and severity of common cold symptoms when started early. Among the interventions studied, Echinacea was the only one that demonstrated a preventive effect against the development of the common cold. Black elderberry and Pelargonium sidoides show meaningful reductions in symptom severity and illness duration in several trials, though the evidence base remains smaller and inconsistent for preventive effects. Vitamin C and Vitamin D may offer benefits only under specific conditions—Vitamin C during high physical stress and Vitamin D in deficiency states—while showing little consistent preventive effect in the general population. Findings for ginseng are variable and insufficient to support firm conclusions. Cloves and Nigella sativa, despite promising traditional and preliminary data, lack robust clinical trials evaluating efficacy against the common cold. Overall, while some supplements may shorten illness or alleviate symptoms, only one reliably prevents colds, underscoring the need for larger, well-designed randomized trials with standardized preparations and clinically relevant endpoints.

Authors contributions:

Research concept and design: Zuzanna Rafałowska, Anna Wojtala, Stanisław Rutz

Data collection and/or compilation: Zuzanna Rafałowska, Paulina Bigda, Michał Szpunar, Adrianna Zabiegałowska, Magda Buśko

Data analysis and interpretation: Zuzanna Rafałowska, Jagoda Pałubska, Oliwer Muller, Jan Gdula, Aleksander Sadkowski

Writing: Zuzanna Rafałowska, Aleksandra Wyrostkiewicz, Julia Kret, Lilianna Zielińska

Supervision, project administration: Zuzanna Rafałowska

All authors have read and agreed to published version of the manuscript.

Funding statement: This research received no external funding.

Conflict of interest statement: The authors reported no potential conflict of interest.

REFERENCES

1. Ahamad, J. (2023). Characterization of essential oil composition of *Syzygium aromaticum* Linn. (clove) by GC-MS and evaluation of its antioxidant activity. *Journal of Angiotherapy, 7*(1). https://doi.org/10.25163/angiotherapy.719358
2. Ahamad, J. (2024). Ethnomedicinal and pharmacological significance of *Syzygium aromaticum* (clove): A review. *Journal of Angiotherapy, 8*(10), 1–6. https://doi.org/10.25163/angiotherapy.8109864
3. Anderson, T. W., Suranyi, G., & Beaton, G. H. (1974). The effect on winter illness of large doses of vitamin C. *Canadian Medical Association Journal, 111*(1), 31. https://pmc.ncbi.nlm.nih.gov/articles/PMC1947567/
4. Aranow, C. (2011). Vitamin D and the immune system. *Journal of Investigative Medicine, 59*(6), 881. https://doi.org/10.231/JIM.0b013e31821b8755
5. Bakaev, V. V., & Duntau, A. P. (2004). Ascorbic acid in blood serum of patients with pulmonary tuberculosis and pneumonia. *The International Journal of Tuberculosis and Lung Disease, 8*(2), 263–266. https://pubmed.ncbi.nlm.nih.gov/15139458/
6. Bhowmik, D., Sampath Kumar, K., Yadav, A., Srivastava, S., Paswan, S., & Dutta, A. (2012). Recent trends in Indian traditional herbs *Syzygium aromaticum* and its health benefits. *Journal of Pharmacognosy and Phytochemistry, 1*(1). https://www.phytojournal.com/archives/2012/vol1issue1/PartA/1.pdf
7. Brinkeborn, R. M., Shah, D. V., & Degenring, F. H. (1999). Echinaforce® and other *Echinacea* fresh plant preparations in the treatment of the common cold. *Phytomedicine, 6*(1), 1–6. https://doi.org/10.1016/S0944-7113(99)80027-0
8. Camargo, C. A., Schaumberg, D. A., Friedenberg, G., Dushkes, R., Glynn, R. J., Gold, D. R., Mora, S., Lee, I. M., Buring, J. E., & Manson, J. E. (2024). Effect of daily vitamin D supplementation on risk of upper respiratory infection in older adults: A randomized controlled trial. *Clinical Infectious Diseases, 78*(5), 1162–1169. https://doi.org/10.1093/cid/ciad770
9. Cantorna, M. T., Snyder, L., Lin, Y.-D., & Yang, L. (2015). Vitamin D and 1,25(OH)2D regulation of T cells. *Nutrients, 7*(4), 3011–3021. https://doi.org/10.3390/nu7043011
10. Careddu, D., & Pettenazzo, A. (2018). *Pelargonium sidoides* extract EPs 7630: A review of its clinical efficacy and safety for treating acute respiratory tract infections in children. *International Journal of General Medicine, 11*, 91–98. https://doi.org/10.2147/IJGM.S154198
11. Carr, A. C., & Maggini, S. (2017). Vitamin C and immune function. *Nutrients, 9*(11), 1211. https://doi.org/10.3390/nu9111211
12. Cerullo, G., Negro, M., Parimbelli, M., Pecoraro, M., Perna, S., Liguori, G., Rondanelli, M., Cena, H., & D'Antona, G. (2020). The long history of vitamin C: From prevention of the common cold to potential aid in the treatment of COVID-19. *Frontiers in Immunology, 11*. https://doi.org/10.3389/fimmu.2020.574029
13. Cho, H.-E., Myung, S.-K., & Cho, H. (2022). Efficacy of vitamin D supplements in prevention of acute respiratory infection: A meta-analysis for randomized controlled trials. *Nutrients, 14*(4), 818. https://doi.org/10.3390/nu14040818
14. Cinatl, J., Wass, M. N., & Michaelis, M. (2024). Multiple mechanisms enable broad-spectrum activity of the *Pelargonium sidoides* root extract EPs 7630 against acute respiratory tract infections. *Frontiers in Pharmacology, 15*. https://doi.org/10.3389/fphar.2024.1455870
15. Dibazar, S. P., Fateh, S., & Daneshmandi, S. (2014). Clove (*Syzygium aromaticum*) ingredients affect lymphocyte subtypes expansion and cytokine profile responses: An in vitro evaluation. *Journal of Food and Drug Analysis, 22*(4), 448–454. https://doi.org/10.1016/j.jfda.2014.04.005
16. Douglas, R. M., & Hemilä, H. (2005). Vitamin C for preventing and treating the common cold. *PLoS Medicine, 2*(6), e168. https://doi.org/10.1371/journal.pmed.0020168
17. EBSCO CAM Review Board. (2024). *Natural treatments for colds and flu*. EBSCO Research Starters. https://www.ebsco.com/research-starters/complementary-and-alternative-medicine/natural-treatments-colds-and-flu#full-article
18. Elango, A., Rao, L. N., Sugumar, P., & Radhakrishnan, A. (2022). Evaluation of clinical efficacy and safety of *Nigella sativa* seed oil added to standard treatment in uncomplicated respiratory infection: A randomised, open labelled, and parallel arm study. *Journal of Communicable Diseases*. https://doi.org/10.24321/0019.5138.202214
19. Evans, M., Falcone, P. H., Crowley, D. C., Sulley, A. M., Campbell, M., Zakaria, N., Lasrado, J. A., Fritz, E. P., & Herrlinger, K. A. (2019). Effect of a *Euglena gracilis* fermentate on immune function in healthy, active adults: A randomized, double-blind, placebo-controlled trial. *Nutrients, 11*(12). https://doi.org/10.3390/nu11122926
20. Ferizi, R., Ramadan, M., & Maxhuni, Q. (2023). Black seeds (*Nigella sativa*) medical application and pharmaceutical perspectives. *Journal of Pharmacy and Bioallied Sciences, 15*(2), 63. https://doi.org/10.4103/jpbs.jpbs_364_22
21. Garland, M. L., & Hagmeyer, K. O. (1998). The role of zinc lozenges in treatment of the common cold. *Annals of Pharmacotherapy, 32*(1), 63–69. https://doi.org/10.1345/aph.17128

22. Gholamnezhad, Z., Shakeri, F., Saadat, S., Ghorani, V., & Boskabady, M. H. (2019). Clinical and experimental effects of *Nigella sativa* and its constituents on respiratory and allergic disorders. *Avicenna Journal of Phytomedicine, 9*(3), 195. https://pmc.ncbi.nlm.nih.gov/articles/PMC6526035/
23. Green, A. (2019). *Anti-respiratory syncytial virus activity of clove extract* [Master's thesis, Sahlgrenska Academy Institute of Biomedicine]. https://gupea.ub.gu.se/handle/2077/64166
24. Harnett, J., Oakes, K., Carè, J., Leach, M., Brown, D., Cramer, H., Pinder, T.-A., Steel, A., & Anheyer, D. (2020). The effects of *Sambucus nigra* berry on acute respiratory viral infections: A rapid review of clinical studies. *Advances in Integrative Medicine, 7*(4). https://doi.org/10.1016/j.aimed.2020.08.001
25. Hemilä, H. (2017). Vitamin C and infections. *Nutrients, 9*(4), 339. https://doi.org/10.3390/nu9040339
26. Hemilä, H., & Chalker, E. (2013). Vitamin C for preventing and treating the common cold. *Cochrane Database of Systematic Reviews, 1*, Article CD000980. https://doi.org/10.1002/14651858.CD000980.pub4
27. Hemilä, H., & Chalker, E. (2023). Vitamin C reduces the severity of common colds: A meta-analysis. *BMC Public Health, 23*(1), 1–13. https://doi.org/10.1186/s12889-023-17229-8
28. Hemilä, H., Petrus, E. J., Fitzgerald, J. T., & Prasad, A. (2016). Zinc acetate lozenges for treating the common cold: An individual patient data meta-analysis. *British Journal of Clinical Pharmacology, 82*(5), 1393–1398. https://doi.org/10.1111/bcp.13057
29. Iftikhar, A., Waseem, M., & Anwar, H. (2024). Combating pediatric pneumonia: The dynamic duo of cinnamon-clove steam and physiotherapy. *Journal of Herbal Medicine*, 100938. https://doi.org/10.1016/j.hermed.2024.100938
30. Jafek, B. W., Linschoten, M. R., & Murrow, B. W. (2004). Anosmia after intranasal zinc gluconate use. *American Journal of Rhinology, 18*(3), 137–141. https://pubmed.ncbi.nlm.nih.gov/15283486/
31. Jasiński, K., Oleksa, P., Żuraw, D., Sobczyk, M., Porzak, M., Sodolska, A., & Pawłowski, B. (2024). The effectiveness of the immune-boosting preparations in prevention and treatment of respiratory infections. *Prospects in Pharmaceutical Sciences, 22*(3), 186–197. https://doi.org/10.56782/pps.190
32. Jawad, M., Schoop, R., Suter, A., Klein, P., & Eccles, R. (2012). Safety and efficacy profile of *Echinacea purpurea* to prevent common cold episodes: A randomized, double-blind, placebo-controlled trial. *Evidence-Based Complementary and Alternative Medicine, 2012*, 1–7. https://doi.org/10.1155/2012/841315
33. Jia, H., Sheng, F., Yan, Y., Liu, X., & Zeng, B. (2024). Vitamin D supplementation for prevention of acute respiratory infections in older adults: A systematic review and meta-analysis. *PLoS ONE, 19*(5), e0303495. https://doi.org/10.1371/journal.pone.0303495
34. Johnson, C. R., & Thacher, T. D. (2023). Vitamin D: Immune function, inflammation, infections and auto-immunity. *Paediatrics and International Child Health*, 1–11. https://doi.org/10.1080/20469047.2023.2171759
35. Karaarslan, O., Ersoy, S., Pala, E., & Engin, V. S. (2024). The efficacy of *Nigella sativa* oil in the prophylaxis and treatment of upper respiratory tract infections in children. *Journal of Functional Foods, 116*, 106193. https://doi.org/10.1016/j.jff.2024.106193
36. Karsch-Völk, M., Barrett, B., Kiefer, D., Bauer, R., Ardjomand-Woelkart, K., & Linde, K. (2014, February 20). *Echinacea for preventing and treating the common cold*. Cochrane. https://www.cochrane.org/evidence/CD000530_echinacea-preventing-and-treating-common-cold
37. Keya, T., Habib, N., & Rashid, M. (2021). Effect of vitamin C supplements on respiratory tract infections: A systematic review and meta-analysis. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3917046
38. Khazdair, M. R., Ghafari, S., & Sadeghi, M. (2021). Possible therapeutic effects of *Nigella sativa* and its thymoquinone on COVID-19. *Pharmaceutical Biology, 59*(1), 694–701. https://doi.org/10.1080/13880209.2021.1931353
39. Kiki, M. J. (2023). In vitro antiviral potential, antioxidant, and chemical composition of clove (*Syzygium aromaticum*) essential oil. *Molecules, 28*(6), 2421. https://doi.org/10.3390/molecules28062421
40. Kolev, E., Mircheva, L., Edwards, M. R., Johnston, S. L., Kalinov, K., Stange, R., Gancitano, G., Berghe, W. V., & Kreft, S. (2022). *Echinacea purpurea* for the long-term prevention of viral respiratory tract infections during COVID-19 pandemic: A randomized, open, controlled, exploratory clinical study. *Frontiers in Pharmacology, 13*. https://doi.org/10.3389/fphar.2022.856410
41. Kumar Pandey, V., Shams, R., Singh, R., Dar, A. H., Pandiselvam, R., Rusu, A. V., & Trif, M. (2022). A comprehensive review on clove (*Caryophyllus aromaticus* L.) essential oil and its significance in the formulation of edible coatings for potential food applications. *Frontiers in Nutrition, 9*. https://doi.org/10.3389/fnut.2022.987674
42. Lizogub, V. G., Riley, D. S., & Heger, M. (2007). Efficacy of a *Pelargonium sidoides* preparation in patients with the common cold: A randomized, double blind, placebo-controlled clinical trial. *EXPLORE, 3*(6), 573–584. https://doi.org/10.1016/j.explore.2007.09.004
43. Mahboubi, M. (2020). *Sambucus nigra* (black elder) as alternative treatment for cold and flu. *Advances in Traditional Medicine, 21*. https://doi.org/10.1007/s13596-020-00469-z
44. Majdalawieh, A. F., Hmaidan, R., & Carr, R. I. (2010). *Nigella sativa* modulates splenocyte proliferation, Th1/Th2 cytokine profile, macrophage function and NK anti-tumor activity. *Journal of Ethnopharmacology, 131*(2), 268–275. https://doi.org/10.1016/j.jep.2010.06.030

45. Mammari, N., Albert, Q., Devocelle, M., Kenda, M., Kočevar Glavač, N., Sollner Dolenc, M., Mercolini, L., Tóth, J., Milan, N., Czigle, S., & Varbanov, M. (2023). Natural products for the prevention and treatment of common cold and viral respiratory infections. *Pharmaceuticals, 16*(5), 662. https://doi.org/10.3390/ph16050662
46. Martineau, A. R., Jolliffe, D. A., Hooper, R. L., Greenberg, L., Aloia, J. F., Bergman, P., Dubnov-Raz, G., Esposito, S., Ganmaa, D., Ginde, A. A., Goodall, E. C., Grant, C. C., Griffiths, C. J., Janssens, W., Laaksi, I., Manaseki-Holland, S., Mauger, D., Murdoch, D. R., Neale, R., & Rees, J. R. (2017). Vitamin D supplementation to prevent acute respiratory tract infections: Systematic review and meta-analysis of individual participant data. *BMJ, 356*, i6583. https://doi.org/10.1136/bmj.i6583
47. McElhaney, J. E., Goel, V., Toane, B., Hooten, J., & Shan, J. J. (2006). Efficacy of COLD-fX in the prevention of respiratory symptoms in community-dwelling adults: A randomized, double-blinded, placebo controlled trial. *The Journal of Alternative and Complementary Medicine, 12*(2), 153–157. https://doi.org/10.1089/acm.2006.12.153
48. Młynarczyk, K., Walkowiak-Tomczak, D., & Łysiak, G. P. (2018). Bioactive properties of *Sambucus nigra* L. as a functional ingredient for food and pharmaceutical industry. *Journal of Functional Foods, 40*, 377–390. https://doi.org/10.1016/j.jff.2017.11.025
49. Mousa, H. A.-L. (2016). Prevention and treatment of influenza, influenza-like illness, and common cold by herbal, complementary, and natural therapies. *Journal of Evidence-Based Complementary & Alternative Medicine, 22*(1), 166–174. https://doi.org/10.1177/2156587216641831
50. Nahas, R., & Balla, A. (2011). Complementary and alternative medicine for prevention and treatment of the common cold. *Canadian Family Physician, 57*(1), 31. https://pmc.ncbi.nlm.nih.gov/articles/PMC3024156/
51. Nault, D., Machingo, T. A., Shipper, A. G., Antiporta, D. A., Hamel, C., Nourouzpour, S., Konstantinidis, M., Phillips, E., Lipski, E. A., & Wieland, L. S. (2024). Zinc for prevention and treatment of the common cold. *Cochrane Database of Systematic Reviews, 2024*(5), Article CD014914. https://doi.org/10.1002/14651858.CD014914.pub2
52. Patrick, G., & Hickner, J. (2008). This obscure herb works for the common cold. *The Journal of Family Practice, 57*(3), 157. https://pmc.ncbi.nlm.nih.gov/articles/PMC3183890/
53. Prasad, A. S., Malysa, A., Bepler, G., Fribley, A., & Bao, B. (2022). The mechanisms of zinc action as a potent anti-viral agent: The clinical therapeutic implication in COVID-19. *Antioxidants, 11*(10), 1862. https://doi.org/10.3390/antiox11101862
54. Predy, G. N., Goel, V., Lovlin, R., Donner, A., Stitt, L., & Basu, T. K. (2005). Efficacy of an extract of North American ginseng containing poly-furanosyl-pyranosyl-saccharides for preventing upper respiratory tract infections: A randomized controlled trial. *Canadian Medical Association Journal, 173*(9), 1043–1048. https://doi.org/10.1503/cmaj.1041470
55. Ran, L., Zhao, W., Wang, H., Zhao, Y., & Bu, H. (2020). Vitamin C as a supplementary therapy in relieving symptoms of the common cold: A meta-analysis of 10 randomized controlled trials. *BioMed Research International, 2020*, 1–9. https://doi.org/10.1155/2020/8573742
56. Read, S. A., Obeid, S., Ahlenstiel, C., & Ahlenstiel, G. (2019). The role of zinc in antiviral immunity. *Advances in Nutrition, 10*(4), 696–710. https://doi.org/10.1093/advances/nmz013
57. Riley, D. S., Lizogub, V. G., Heger, M., Funk, P., Mueller, H., & Lehmacher, W. (2019). Treatment with EPs 7630, a *Pelargonium sidoides* root extract, is effective and safe in patients with the common cold: Results from a randomized, double blind, placebo-controlled clinical trial. *Integrative Medicine, 18*(1), 42. https://pmc.ncbi.nlm.nih.gov/articles/PMC6601435/
58. Rondanelli, M., Miccono, A., Lamburghini, S., Avanzato, I., Riva, A., Allegrini, P., Faliva, M. A., Peroni, G., Nichetti, M., & Perna, S. (2018). Self-care for common colds: The pivotal role of vitamin D, vitamin C, zinc, and *Echinacea* in three main immune interactive clusters (physical barriers, innate and adaptive immunity) involved during an episode of common colds—Practical advice on dosages and on the time to take these nutrients/botanicals in order to prevent or treat common colds. *Evidence-Based Complementary and Alternative Medicine, 2018*, 1–36. https://doi.org/10.1155/2018/5813095
59. Salem, A., Bamosa, A., Alam, M., Alshuraim, S., Alyalak, H., Alagga, A., Tarabzouni, F., Alisa, O., Sabit, H., Mohsin, A., Shaikh, M., Farea, A., Alshammari, T., & Obeid, O. (2023). Effect of *Nigella sativa* on general health and immune system in young healthy volunteers: A randomized, placebo-controlled, double-blinded clinical trial. *F1000Research, 10*, 1199. https://doi.org/10.12688/f1000research.73524.2
60. Science, M., Johnstone, J., Roth, D. E., Guyatt, G., & Loeb, M. (2012). Zinc for the treatment of the common cold: A systematic review and meta-analysis of randomized controlled trials. *Canadian Medical Association Journal, 184*(10), E551–E561. https://doi.org/10.1503/cmaj.111990
61. Seida, J. K., Durec, T., & Kuhle, S. (2011). North American (*Panax quinquefolius*) and Asian ginseng (*Panax ginseng*) preparations for prevention of the common cold in healthy adults: A systematic review. *Evidence-Based Complementary and Alternative Medicine, 2011*, 1–7. https://doi.org/10.1093/ecam/nep068
62. Shahrajabian, M. H., Sun, W., & Cheng, Q. (2020). Traditional herbal medicine for the prevention and treatment of cold and flu in the autumn of 2020, overlapped with COVID-19. *Natural Product Communications, 15*(8), 1934578X20951431. https://doi.org/10.1177/1934578X20951431

63. Shankar, A. H., & Prasad, A. S. (1998). Zinc and immune function: The biological basis of altered resistance to infection. *The American Journal of Clinical Nutrition, 68*(2), 447S–463S. https://doi.org/10.1093/ajcn/68.2.447S
64. Shokri-Mashhadi, N., Kazemi, M., Saadat, S., & Moradi, S. (2021). Effects of select dietary supplements on the prevention and treatment of viral respiratory tract infections: A systematic review of randomized controlled trials. *Expert Review of Respiratory Medicine*, 1–17. https://doi.org/10.1080/17476348.2021.1918546
65. Stich, L., Plattner, S., McDougall, G., Austin, C., & Steinkasserer, A. (2022). Polysaccharides from European black elderberry extract enhance dendritic cell mediated T cell immune responses. *International Journal of Molecular Sciences, 23*(7), 3949. https://doi.org/10.3390/ijms23073949
66. Timmer, A., Günther, J., Motschall, E., Rücker, G., Antes, G., & Kern, W. V. (2013). *Pelargonium sidoides* extract for treating acute respiratory tract infections. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.CD006323.pub3
67. Tiralongo, E., Wee, S., & Lea, R. (2016). Elderberry supplementation reduces cold duration and symptoms in air-travellers: A randomized, double-blind placebo-controlled clinical trial. *Nutrients, 8*(4), 182. https://doi.org/10.3390/nu8040182
68. van Gorkom, G. N. Y., Klein Wolterink, R. G. J., Van Elssen, C. H. M. J., Wieten, L., Germeraad, W. T. V., & Bos, G. M. J. (2018). Influence of vitamin C on lymphocytes: An overview. *Antioxidants, 7*(3), 41. https://doi.org/10.3390/antiox7030041
69. Vicidomini, C., Roviello, V., & Roviello, G. N. (2021). Molecular basis of the therapeutical potential of clove (*Syzygium aromaticum* L.) and clues to its anti-COVID-19 utility. *Molecules, 26*(7), 1880. https://doi.org/10.3390/molecules26071880
70. Wang, C.-H., Porta, L., Yang, T.-K., Wang, Y.-H., Wu, T.-H., Qian, F., Han, Y.-Y., Sheng, W.-H., Chen, S.-C., Lee, C.-C., & Chang, S.-C. (2024). Optimal methods of vitamin D supplementation to prevent acute respiratory infections: A systematic review, dose-response and pairwise meta-analysis of randomized controlled trials. *Nutrition Journal, 23*(1). https://doi.org/10.1186/s12937-024-00990-w
71. Wang, M. X., Win, S. S., & Pang, J. (2020). Zinc supplementation reduces common cold duration among healthy adults: A systematic review of randomized controlled trials with micronutrients supplementation. *The American Journal of Tropical Medicine and Hygiene, 103*(1). https://doi.org/10.4269/ajtmh.19-0718
72. Weir, E. K., Thenappan, T., Bhargava, M., & Chen, Y. (2020). Does vitamin D deficiency increase the severity of COVID-19? *Clinical Medicine, 20*(4), clinmed.2020-0301. https://doi.org/10.7861/clinmed.2020-0301
73. Weishaupt, R., Bächler, A., Feldhaus, S., Lang, G., Klein, P., & Schoop, R. (2020). Safety and dose-dependent effects of *Echinacea* for the treatment of acute cold episodes in children: A multicenter, randomized, open-label clinical trial. *Children, 7*(12), 292. https://doi.org/10.3390/children7120292
74. Wessels, I., Maywald, M., & Rink, L. (2017). Zinc as a gatekeeper of immune function. *Nutrients, 9*(12), 1286. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5748737/
75. Wieland, L. S., Piechotta, V., Feinberg, T., Ludeman, E., Hutton, B., Kanji, S., Seely, D., & Garritty, C. (2021). Elderberry for prevention and treatment of viral respiratory illnesses: A systematic review. *BMC Complementary Medicine and Therapies, 21*(21). https://doi.org/10.1186/s12906-021-03283-5
76. Xie, Z., Chen, J., Zheng, C., Wu, J., Cheng, Y., Zhu, S., Lin, C., Cao, Q., Zhu, J., & Jin, T. (2017). 1,25-dihydroxyvitamin D3-induced dendritic cells suppress experimental autoimmune encephalomyelitis by increasing proportions of the regulatory lymphocytes and reducing T helper type 1 and type 17 cells. *Immunology, 152*(3), 414–424. https://doi.org/10.1111/imm.12776
77. Yoo, D.-G., Kim, M.-C., Park, M.-K., Song, J.-M., Quan, F.-S., Park, K.-M., Cho, Y.-K., & Kang, S.-M. (2012). Protective effect of Korean red ginseng extract on the infections by H1N1 and H3N2 influenza viruses in mice. *Journal of Medicinal Food, 15*(10), 855–862. https://doi.org/10.1089/jmf.2012.0017
78. Zakay-Rones, Z., Thom, E., Wollan, T., & Wadstein, J. (2004). Randomized study of the efficacy and safety of oral elderberry extract in the treatment of influenza A and B virus infections. *Journal of International Medical Research, 32*(2), 132–140. https://doi.org/10.1177/147323000403200205