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Review Article

Role of Vitamin C for the Treatment of COVID-19: An Umbrella Review

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is an infectious illness resulting from the SARS-CoV-2 virus. The immune system overactivation triggered by this virus results in multiple organ damage. This infection has the potential to cause acute respiratory distress syndrome and may progress to respiratory failure, both of which can be life-threatening. Vitamin C is proposed as a possible treatment for immune system overactivation due to its antioxidant properties.
Methods: This umbrella review seeks to evaluate the effectiveness of vitamin C in the management of COVID-19 infection. To identify pertinent literature, we conducted searches across Embase, PubMed, Scopus, and Web of Science databases. Our analysis incorporated eight systematic reviews and meta-analyses that examined the impact of vitamin C on COVID-19 treatment outcomes.
Results: Our findings revealed that the odds ratio (OR) of mortality in the vitamin C group is 0.55 (0.48-0.63). The duration of hospitalization did not differ between the groups and the need for mechanical ventilation in both groups. This umbrella review discusses the use of vitamin C in COVID-19 patients, highlighting its potential to reduce mortality rates. While the duration and dose of treatment vary There was no notable distinction observed between the vitamin C group and the control groups in hospital length, ICU stay, or mechanical ventilation days.
Conclusion: The study suggests further research to determine its effectiveness in reducing mortality rates and suggests larger studies with a more specific protocol.

Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus [1], which was first reported in Wuhan, China, in December 2019 [2]. The mortality rate of COVID-19 is estimated to be 14.83 between 2020 and 2021 [3]. The SARS-CoV-2 virus triggers the immune system into an uncontrolled cytokine storm, which damages multiple organs, especially the lungs, resulting in acute respiratory syndrome [4]. Although the role of

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free radicals in COVID-19 is still not clearly understood, there is a strong hypothesis that it may play a pivotal role. The secreted cytokines enhance the production of free radicals in response to other respiratory infections [5-6]. These suggest the potential role of antioxidant and anti-inflammatory substrates in treating COVID-19 to reduce future lung damage [7]. The baricitinib study highlights the potential benefits of anti-inflammatory agents, demonstrating a reduction in mortality and ICU transfers. This corresponds with the approach of reducing the cytokine storm frequently seen in severe cases of COVID-19. This non-pharmacological intervention offers a valuable adjunct to medical management. These findings collectively underscore the multifaceted nature of COVID-19 and the need for a multi-pronged approach that combines pharmacological interventions, supportive care strategies, and immunomodulatory therapies to improve patient outcomes [8-9]. Vitamin C (ascorbic acid) is a known and readily available anti-inflammatory and antioxidant nutrient [10]. In mice studies, Vitamin C is shown to reduce the mortality of pneumonia caused by the H1N1 influenza virus due to its immunomodulatory effects [11]. Other studies also report reduced mortality in patients with pneumonia or sepsis taking vitamin C [12-13]. A retrospective study also reported reduced organ damage in patients taking vitamin C, especially if used with hydrocortisone and thiamine [14-15]. Multiple systematic reviews and meta-analyses are conducted to determine the effect of vitamin C therapy on COVID-19 severity, need for ventilation, mortality, and post-COVID fatigue syndrome. Some studies show a reduced mortality rate in groups with vitamin C treatment, while others fail to show this. While the results of vitamin C studies have been mixed, some evidence suggests potential benefits in certain patient populations. This umbrella review is conducted to review the previous studies published in this field, compare their methodology, and determine the role of vitamin C in COVID-19 treatment.

Methods

The protocol was documented in the International Prospective Register of Systematic Reviews (PROSPERO/NHS) under the registration number CRD420251002928. In this umbrella review, we searched the PubMed, Scopus, Embase, and Web of Science databases to find eligible studies until October 2024. The search was conducted using the following keywords. “SARS-COVID infection,” “COVID-19 infection,” “ascorbic acid,” “vitamin C,” and related terms. The detailed search strategies are present in Supplementary File 1). We used the systematic review and meta-analysis filter in the search process.

Inclusion and exclusion criteria

We included systematic reviews and meta-analyses of original studies that used vitamin C (IV or oral) in SARS-COVID-19 patients. We excluded animal studies, book chapters, conference abstracts, literature review studies, original studies, studies that didn’t include SARS-COVID-19 patients, case reports, and case series.

Study selection and quality assessment

Two authors separately screened the studies based on their title/abstract. After that, the included studies underwent full-text screening to identify the eligible studies. In instances where disagreements arose, the perspective of a third author was sought to reach a resolution. We used the JBI checklist to assess the quality of the systematic reviews. The JBI critical appraisal instruments for systematic reviews were employed to evaluate studies related to mythology (search strategies, selected resources, the inclusion of studies, quality assessment by each study, etc.), methods used to minimize bias or calculate the likelihood of possible publication bias, and consistency of results with recommended practices.

Data extraction and synthesis

The title of studies, their first-named authors, types of included studies, total number of participants, number of included studies, country, their used checklist for quality assessment, and the results of using vitamin C on mortality, hospitalization length, intubation length, and disease outcome were extracted from the studies. The results of the studies were synthesized using tables, and data analysis was conducted with the Review Manager 5.4.1 software. The degree of heterogeneity among the studies was assessed using the I^2 statistic, with values exceeding 50% indicating substantial heterogeneity. Statistical significance was defined as a p-value less than 0.01.

Results

A primary search of the databases identified 1588 studies that went under screening. After the screening, eight systematic reviews entered our umbrella review [16-23]. All studies included randomized control trials, two included observational studies [13-14], and three included retrospective studies [19-20, 22]. Only one study didn't have any meta-analysis [22]. (Figure 1) summarizes the study's PRISMA flow chart. In total, 78 original studies with 9194 participants were included in this study. The sample size of the studies ranged from 572 to 1801. One study included the post-COVID patients [22], and the rest included COVID-19 patients. Two studies included critically ill patients [17, 19]. Three

studies [16, 19, 22] used only intravenous formulations of vitamin C; the rest used intravenous (IV) and oral formulations. The duration and dose of treatment differed between studies and ranged from 5 to 28 days and 0.2 to 24 g/day.

Seven studies assessed the effect of using vitamin C on the mortality of the treatment group. There were 7481 patients in this analysis (2863 in the treatment and 4618 in the control group) [16-21, 23]. The reported heterogeneity between the studies was I^2 = 18%. The reported odds ratio (OR) of the mortality in the treatment group was 0.55 (0.48-0.63) with a P value of <0.00001. (Figure 2) demonstrates the forest plot of the use of vitamin C on COVID-19 mortality. Use of vitamin C in IV formulation results in an OR of mortality equal to 0.49 (0.35-0.69). This analysis included 1086 participants and is demonstrated in (Figure 3). Only one study assessed the OR of mortality for the vitamin C group when administered through the oral route [20]. They reported an OR of 0.38 (0.17-0.89). When studies with RCT studies were analyzed, the OR of mortality was equal to 0.53 (0.43-0.64) with a P value of 0.00001 (Figure 4).

Three studies reported the hospital length of the vitamin C group and compared them to control groups [19-21]. All three studies reported that the hospital stay between the two groups didn't differ. Three studies assessed the intensive care unit (ICU) stay between the two groups [17, 20-21]. Two studies report 1.56-1.91 days longer ICU stay for the vitamin C group [17, 20], and one study doesn't report any difference between the two groups [21]. Also, two studies assess the role of vitamin C in lowering the mechanical ventilation days for patients with COVID-19. None of them showed any difference in mechanical ventilation days between the two groups [17, 21]. One study reported the OR of acute kidney injury in the vitamin C group to be 0.56 (0.4-0.78) [20]. One study reported no difference between the two groups for renal replacement therapy for critically ill patients with COVID-19 infection with a relative risk (RR) of 1.27 (0.68—2.39) [17]. Supplementary file 2) provides the details of each, including a systematic review in the current umbrella review.

(Table 1) presents a summary of the methodological quality evaluation. The findings indicate that the majority of the systematic reviews assessed demonstrated moderate to high methodological quality.

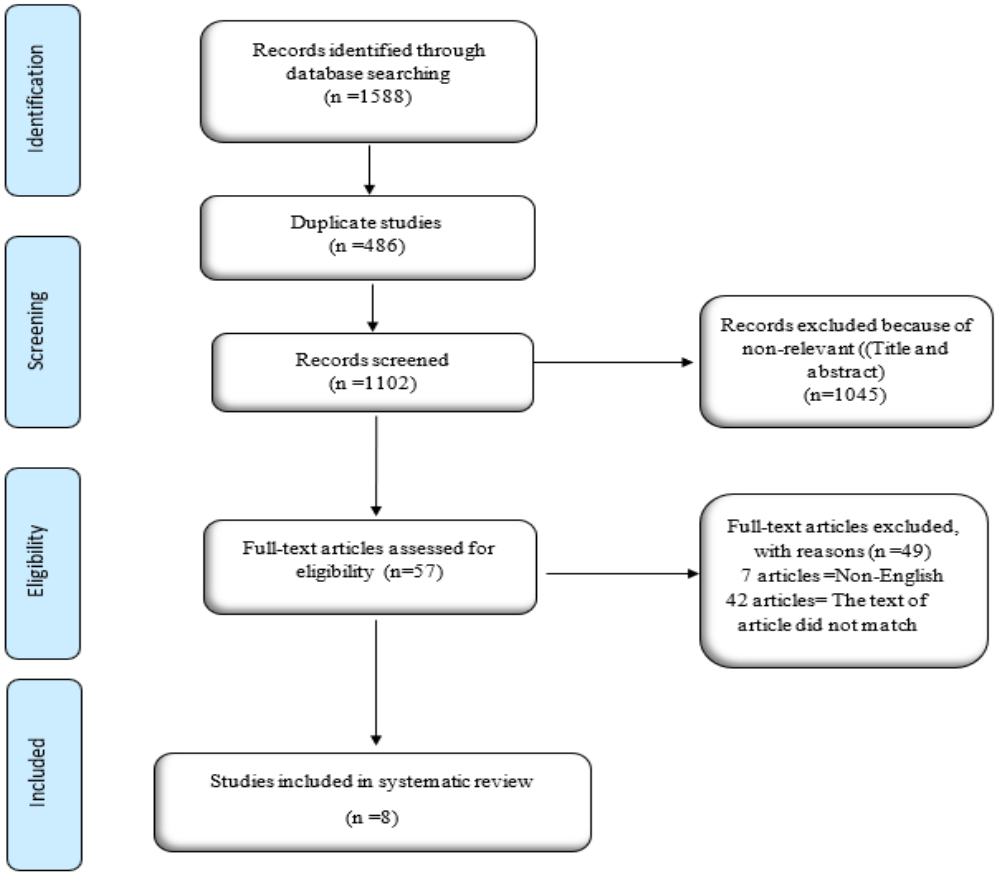

Figure 1- Study's PRISMA flow chart

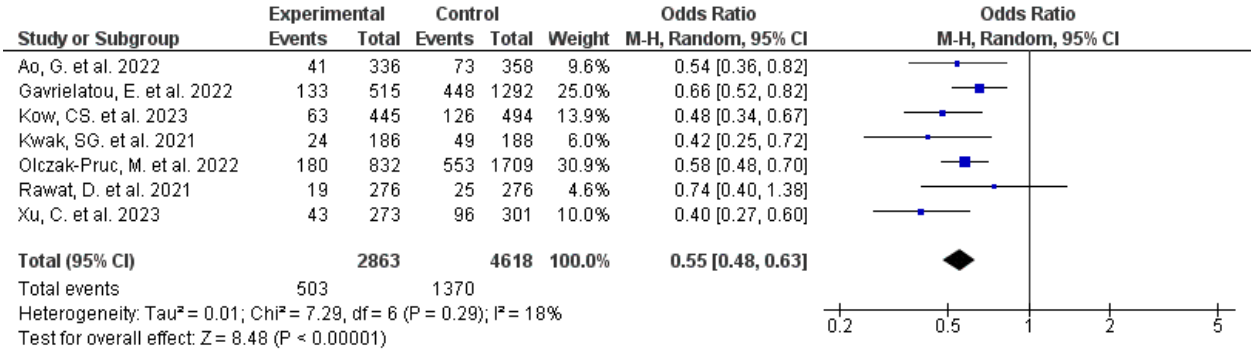

Figure 2- The forest plot of the use of vitamin C on COVID-19 mortality.

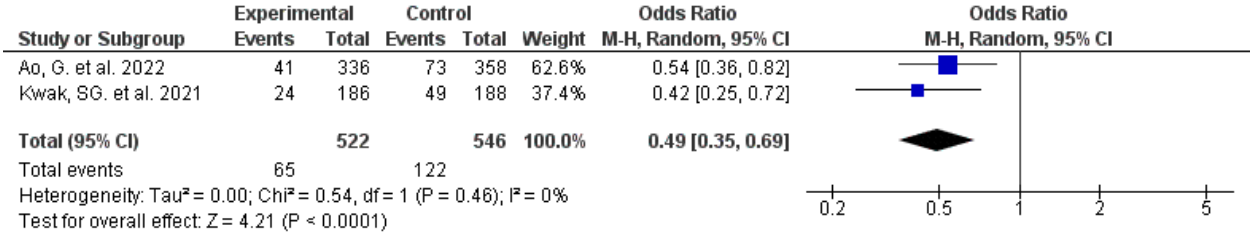

Figure 3- vitamin C in IV formulation results on mortality.

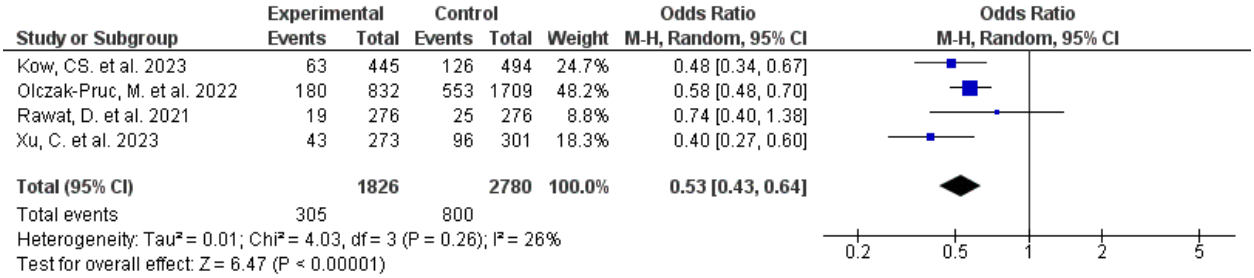

Figure 4- Effect of vitamin C on mortality in RCTs.

Table 1- Critical appraisal of the included systematic reviews according to the JBI checklist (https://jbi.global/critical-appraisal-tools)

Author	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Xu, 2023 [23]	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes
Kow, 2023 [18]	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	N/A	Unclear	Yes
Gavrielatou, 2022 [17]	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	N/A	Unclear	Yes
Olczak-Pruc, 2022 [20]	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	N/A	Unclear	Yes
Vollbracht, 2021 [22]	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	N/A	N/A	Unclear	Yes
Ao, 2022 [16]	Yes	Yes	Unclear	Yes	No	No	Yes	N/A	N/A	Unclear	Yes
Rawat, 2021 [21]	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	N/A	Unclear	Yes
Kwak, 2021 [19]	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes

Q1.Is the review question clearly and explicitly stated? Q2.Were the inclusion criteria appropriate for the review question? Q3.Was the search strategy appropriate? Q4.Were the sources and resources used to search for studies adequate? Q5.Were the criteria for appraising studies appropriate? Q6.Was critical appraisal conducted by two or more reviewers independently? Q7.Were there methods to minimize errors in data extraction? Q8.Were the methods used to combine studies appropriate? Q9.Was the likelihood of publication bias assessed? Q10.Were recommendations for policy and/or practice supported by the reported data? Q11.Were the specific directives for new research appropriate?

Discussion

This umbrella review was undertaken to evaluate various facets of vitamin C administration in patients with COVID-19, in addition to standard treatment protocols. Our umbrella review showed that using vitamin C decreases the mortality rates of COVID-19 patients. These results were seen in both IV and oral vitamin C uses. However, most of the studies included both IV and oral formulations and didn't separate between them. The enteric absorption ratio for vitamin C is not 100%, and this rate is reported to decrease as the oral dose of vitamin C increases [24]. These underscore the importance of the oral route as a secure way to deliver vitamin C to critically ill patients. The predominant theory regarding lung damage in individuals with COVID-19 is the excessive activation of the immune response [25]. The overactivated immune system then attacks the infected cells and releases reactive oxygen species (ROS), damaging the healthy cells. Vitamin C acts as an antioxidant and reduces the level of ROS, which may reduce the damage to healthy cells and mortality.

Our research found no significant variation between the two groups regarding length of hospital stay or requirement for mechanical ventilation. The relationship between ICU stays and vitamin C administration conflicted between the studies. Generally, the studies with larger sample sizes showed a longer ICU stay in vitamin C groups [17, 20]. This administration of vitamin C may increase the length of ICU stay in critically ill patients but doesn't affect the hospital stay of patients. The hospital stay for COVID-19 patients is reported to be more than 10 days [26]. However, this length of stay depends on the age of patients and is higher for older patients. The included studies didn't assess the effect of age on length of stay, which may cause the reported results. Vitamin C also didn't affect the need for mechanical. According to a study by Wunsch et al. [27], 2.1-33.1% of COVID-19 patients need mechanical ventilation. These findings suggest that while vitamin C may not influence the progression or severity of COVID-19 in patients, it could contribute to a reduction in mortality rates among those affected. A study reported the efficacy of high-dose vitamin C in critically ill COVID-19 patients. 210 patients with respiratory failure were randomized to receive standard care with or without vitamin C. While vitamin C significantly reduced C-reactive protein levels, there were no significant differences between groups in mortality, hospital length of stay, oxygen saturation, or other key outcomes [28].

A study evaluated the clinical outcomes of 400 individuals with mild COVID-19 who were released from emergency departments. The results indicate that patients with pre-existing medical conditions exhibit a markedly increased mortality rate relative to individuals without such conditions. Additionally, patients who disregarded hygiene guidelines after discharge were more likely to spread the virus to their families [7]. The studies differed in the dose of vitamin C and duration of treatment. They also didn't report the baseline serum vitamin C levels in the COVID-19 patients before vitamin C administration. A study by Sinnberg et al. [29] reports that lower serum vitamin C concentrations increase hospital stays and mortality rates. A related investigation conducted by Chiscano-Camon et al. [30] found that patients admitted to the ICU with respiratory failure resulting from COVID-19 infection exhibited undetectable levels of vitamin C. It has been documented that vitamin C contributes to strengthening the epithelial barrier of the lungs [31]. Vitamin C deficiency can result in epithelial cell dysfunction and facilitate the progression of respiratory failure in COVID-19 patients. The administration of vitamin C can improve the lung function and reduce the mortality rates. The effectiveness of vitamin C has been demonstrated in additional research [32]. One particular study examined how vitamin C influences the suppression of cortisol caused by etomidate in trauma patients undergoing Rapid Sequence Intubation (RSI).

Fifty-one patients were randomized to receive either etomidate alone or etomidate preceded by one gram of vitamin C. Cortisol levels were measured three hours post-RSI. While both groups experienced cortisol suppression after etomidate administration, the group receiving vitamin C exhibited significantly higher cortisol levels compared to the control group. These findings suggest that vitamin C may mitigate the adrenocortical suppression caused by etomidate in trauma patients undergoing RSI [33]. Our study has some limitations. First, the difference in dose and duration of vitamin C supplements prevented us from assessing the best regimen for COVID-19 patients. Secondly, we didn't differentiate between IV and oral administration. Oral administration is not equal to IV administration, and the inflammation may further affect the oral absorption of vitamin C. However, the oral route is much easier and cheaper than the IV. The inclusion of both intravenous and oral formulations of vitamin C introduces variability that complicates comparisons. The different routes of administration may yield different pharmacokinetics and clinical effects, which were not uniformly assessed across studies.

Moreover, various studies assessed different outcomes—such as mortality, length of ICU stay, and duration of mechanical ventilation—without employing a uniform methodology. This lack of standardization complicates the ability to reach clear conclusions regarding the overall effectiveness of vitamin C across

these parameters. Another notable limitation was the absence of extended follow-up in the reviewed studies. The majority concentrated on short-term results, resulting in insufficient data regarding the long-term impact and safety profile of vitamin C supplementation in patients with COVID-19.

Vitamin C has been widely explored as a potential therapeutic agent for COVID-19, with varying degrees of reported efficacy. While some studies suggest a possible benefit, particularly in specific subgroups, others have found no significant impact on disease progression or mortality. It's crucial to consider the totality of evidence when evaluating the role of vitamin C in COVID-19 management. For instance, while hydroxychloroquine and azithromycin were initially considered as potential treatments for COVID-19, subsequent research, as highlighted in a recent umbrella review [34], demonstrated a lack of clinical benefit and even raised concerns about adverse cardiac events. This highlights the necessity for thorough assessment of all possible COVID-19 treatments, including vitamin C. In addition, research targeting particular patient groups, such as individuals with mild symptoms who are released from the emergency department [7], offers important understanding of the disease's progression and the effects that interventions like vitamin C may have.

Future research should aim to standardize treatment protocols, including dosage, duration, and formulation of vitamin C used, to facilitate more accurate comparisons and meta-analyses. Investigating vitamin C's effects in combination with other treatments could provide insights into synergistic benefits and optimize therapeutic strategies for COVID-19 management. Incorporating observational studies and real-world data can complement RCT findings, providing a more comprehensive understanding of vitamin C's impact in diverse healthcare settings. In addition, future research should explore the underlying mechanisms by which vitamin C may affect COVID-19 outcomes to better understand its role in immune response and recovery.

Conclusion

This umbrella review summarizes the current evidence regarding the application of vitamin C in individuals diagnosed with COVID-19. Severe pneumonia and elevated mortality rates are recognized complications of COVID-19. Observational data indicate that vitamin C deficiency is prevalent among these patients and correlates with unfavorable clinical outcomes. Administration of vitamin C has been associated with a reduction in mortality (OR: 0.55) among COVID-19 patients. Nonetheless, some findings suggest a potential increase in ICU length of stay within the vitamin C group. Treatment regimens, including dosage and duration, varied across the included studies. Additionally, no significant differences were observed between the vitamin C and control groups concerning total hospital stay, ICU days, or duration of mechanical ventilation. The methodological evaluation indicated that most systematic reviews included were of moderate to high quality. In conclusion, while vitamin C appears to be beneficial for patients with COVID-19, additional research is necessary to clarify its impact on mortality reduction. There is no specific regimen for vitamin C. For future studies, we suggest larger studies with a more specific protocol and comparison between IV and oral route administrations.

Acknowledgment

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Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was approved by the regional ethics committee with No. IR.TBZMED.REC.1402.888. I confirm that all methods were carried out in accordance with relevant guidelines and regulations.

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Supplementary

Supplementary file 1- Search strategy in the databases

Embase
('coronavirus disease 2019'/exp/mj OR '2019 novel coronavirus disease':ti,ab OR '2019 novel coronavirus epidemic':ti,ab OR '2019 novel coronavirus infection':ti,ab OR '2019-nCoV disease':ti,ab OR '2019-nCoV infection':ti,ab OR 'COVID':ti,ab OR 'COVID 19':ti,ab OR 'COVID 2019':ti,ab OR 'COVID-10':ti,ab OR 'COVID-19':ti,ab OR 'COVID19':ti,ab OR 'SARS coronavirus 2 infection':ti,ab OR 'SARS-CoV-2 disease':ti,ab OR 'SARS-CoV-2 infection':ti,ab OR 'SARS-CoV2 disease':ti,ab OR 'SARS-CoV2 infection':ti,ab OR 'SARSCoV2 disease':ti,ab OR 'SARSCoV2 infection':ti,ab OR 'Wuhan coronavirus disease':ti,ab OR 'Wuhan coronavirus infection':ti,ab OR 'coronavirus disease 2':ti,ab OR 'coronavirus disease 2010':ti,ab OR 'coronavirus disease 2019':ti,ab OR 'coronavirus disease-19':ti,ab OR 'coronavirus infection 2019':ti,ab OR 'nCoV 2019 disease':ti,ab OR 'nCoV 2019 infection':ti,ab OR 'novel coronavirus 2019 disease':ti,ab OR 'novel coronavirus 2019 infection':ti,ab OR 'novel coronavirus disease 2019':ti,ab OR 'novel coronavirus infection 2019':ti,ab OR 'paucisymptomatic coronavirus disease 2019':ti,ab OR 'severe acute respiratory syndrome 2':ti,ab OR 'severe acute respiratory syndrome CoV-2 infection':ti,ab OR 'severe acute respiratory syndrome coronavirus 2 infection':ti,ab OR 'severe acute respiratory syndrome coronavirus 2019 infection':ti,ab) AND ('ascorbic acid'/exp/mj OR 'acidum ascorbicum':ti,ab OR 'acidylina':ti,ab OR 'adenex':ti,ab OR 'afj c':ti,ab OR 'agrumina':ti,ab OR 'allercorb':ti,ab OR 'allescorb':ti,ab OR 'antiscorbutic vitamin':ti,ab OR 'arcavit c':ti,ab OR 'arcavite c':ti,ab OR 'arkovital c':ti,ab OR 'ascelat':ti,ab OR 'ascofar':ti,ab OR 'ascomed':ti,ab OR 'asconvita':ti,ab OR 'ascor':ti,ab OR 'ascor l 500':ti,ab OR 'ascorbate':ti,ab OR 'ascorbate sodium':ti,ab OR 'ascorbic acid':ti,ab OR 'ascorbic acid potassium salt':ti,ab OR 'ascorbicap':ti,ab OR 'ascorbicin':ti,ab OR 'ascorbico':ti,ab OR 'ascorbin':ti,ab OR 'ascorbina':ti,ab OR 'ascorbinic acid':ti,ab OR 'ascorbit':ti,ab OR 'ascorbite':ti,ab OR 'ascorbitol':ti,ab OR 'ascorbivit':ti,ab OR 'ascorbivite':ti,ab OR 'ascorbone':ti,ab OR 'ascorbutina':ti,ab OR 'ascorbyl':ti,ab OR 'ascorbyn':ti,ab OR 'ascorcee':ti,ab OR 'ascorgil':ti,ab OR 'ascorin':ti,ab OR 'ascormin':ti,ab OR 'ascorteal':ti,ab OR 'ascorval':ti,ab OR 'ascorvel':ti,ab OR 'ascorvit':ti,ab OR 'ascorvite':ti,ab OR 'ascorvitina':ti,ab OR 'askorbin':ti,ab OR 'austrovit c':ti,ab OR 'austrovite c':ti,ab OR 'bentavit c':ti,ab OR 'bentavite c':ti,ab OR 'c crivit':ti,ab OR 'c ine':ti,ab OR 'c level':ti,ab OR 'c lisa':ti,ab OR 'c long':ti,ab OR 'c monovit':ti,ab OR 'c monovite':ti,ab OR 'c prana':ti,ab OR 'c rivitin':ti,ab OR 'c rivitine':ti,ab OR 'c sol':ti,ab OR 'c tamin':ti,ab OR 'c tamine':ti,ab OR 'c tonic':ti,ab OR 'c tron':ti,ab OR 'c vescent':ti,ab OR 'c vicotrat':ti,ab OR 'c vicotrate':ti,ab OR 'c vimin':ti,ab OR 'c vimine':ti,ab OR 'c vit':ti,ab OR 'c vita':ti,ab OR 'c vital':ti,ab OR 'c vitam':ti,ab OR 'c vite':ti,ab OR 'c-tard':ti,ab OR 'c-vimin':ti,ab OR 'c-will':ti,ab OR 'cantan':ti,ab OR 'cantaxin':ti,ab OR 'catavin c':ti,ab OR 'ce arom':ti,ab OR 'ce limo':ti,ab OR 'ce major':ti,ab OR 'ce quin':ti,ab OR 'ce quine':ti,ab OR 'ce vi sol':ti,ab OR 'ce vita':ti,ab OR 'ce vitan':ti,ab OR 'ce-vi-sol':ti,ab OR 'cebetate':ti,ab OR 'cebicure':ti,ab OR 'cebiolon':ti,ab OR 'cebion':ti,ab OR 'cebione':ti,ab OR 'cecap':ti,ab OR 'cecon':ti,ab OR 'cecon drops':ti,ab OR 'cecon solution':ti,ab OR 'cecone':ti,ab OR 'cecorbin':ti,ab OR 'cecorbine':ti,ab OR 'cecorbyl':ti,ab OR 'cecorbyle':ti,ab OR 'cecrisina':ti,ab OR 'cedon':ti,ab OR 'cedone':ti,ab OR 'cedoxon':ti,ab OR 'cedoxone':ti,ab OR 'cee-500':ti,ab OR 'ceevifil':ti,ab OR 'cegiolan':ti,ab OR 'celaskon':ti,ab OR 'celaskone':ti,ab OR 'celin':ti,ab OR 'celine':ti,ab OR 'cenetone':ti,ab OR 'cenol':ti,ab OR 'cenolate':ti,ab OR 'cequinyl':ti,ab OR 'cereon':ti,ab OR 'cergona':ti,ab OR 'cescorbat':ti,ab OR 'cetamican':ti,ab OR 'cetamid':ti,ab OR 'cetamin knoll australia':ti,ab OR 'cetamine':ti,ab OR 'cetamine knoll australia':ti,ab OR 'cetebe':ti,ab OR 'ceterapion':ti,ab OR 'ceterapione':ti,ab OR 'cetrinets':ti,ab OR 'cevalin':ti,ab OR 'cevaline':ti,ab OR 'cevatine':ti,ab OR 'cevex':ti,ab OR 'cevibram':ti,ab OR 'cevigal':ti,ab OR 'cevigen':ti,ab OR 'cevigol':ti,ab OR 'cevikap':ti,ab OR 'cevilat':ti,ab OR 'cevimin':ti,ab OR 'cevimine':ti,ab OR 'cevisol':ti,ab OR 'cevit':ti,ab OR 'cevita':ti,ab OR 'cevitamic acid':ti,ab OR 'cevitamin':ti,ab OR 'cevitaminic

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PubMed
Search: (("COVID-19"[Mesh]) AND "Ascorbic Acid"[Mesh]) OR (("coronavirus disease 2019"[Text Word] OR "2019 novel coronavirus disease"[Text Word] OR "2019 novel coronavirus epidemic"[Text Word] OR "2019 novel coronavirus infection"[Text Word] OR "2019-nCoV disease"[Text Word] OR "2019-nCoV infection"[Text Word] OR "COVID"[Text Word] OR "COVID 19"[Text Word] OR "COVID 2019"[Text Word] OR "COVID-10"[Text Word] OR "COVID-19"[Text Word] OR "COVID19"[Text Word] OR "SARS coronavirus 2 infection"[Text Word] OR "SARS-CoV-2 disease"[Text Word] OR "SARS-CoV-2 infection"[Text Word] OR "SARS-CoV2 disease"[Text Word] OR "SARS-CoV2 infection"[Text Word] OR "SARSCoV2 disease"[Text Word] OR "SARSCoV2 infection"[Text Word] OR "Wuhan coronavirus disease"[Text Word] OR "Wuhan coronavirus infection"[Text Word] OR "coronavirus disease 2"[Text Word] OR "coronavirus disease 2010"[Text Word] OR "coronavirus disease 2019"[Text Word] OR "coronavirus disease-19"[Text Word] OR "coronavirus infection 2019"[Text Word] OR "nCoV 2019 disease"[Text Word] OR "nCoV 2019 infection"[Text Word] OR "novel coronavirus 2019 disease"[Text Word] OR "novel coronavirus 2019 infection"[Text Word] OR "novel coronavirus disease 2019"[Text Word] OR "novel coronavirus infection 2019"[Text Word] OR "paucisymptomatic coronavirus disease 2019"[Text Word] OR "severe acute respiratory syndrome 2"[Text Word] OR "severe acute respiratory syndrome CoV-2 infection"[Text Word] OR "severe acute respiratory syndrome coronavirus 2 infection"[Text Word] OR "severe acute respiratory syndrome coronavirus 2019 infection"[Text Word]) AND ("ascorbic acid "[Text Word] OR "acidum ascorbicum "[Text Word] OR "acidylina "[Text Word] OR "adenex "[Text Word] OR "afj c "[Text Word] OR "agrumina "[Text Word] OR "allercorb "[Text Word] OR "allescorb "[Text Word] OR "antiscorbutic vitamin "[Text Word] OR "arcavit c "[Text Word] OR "arcavite c "[Text Word] OR "arkovital c "[Text Word] OR "ascelat "[Text Word] OR "ascofar "[Text Word] OR "ascomed "[Text Word] OR "asconvita "[Text Word] OR "ascor "[Text Word] OR "ascor l 500 "[Text Word] OR "ascorbate "[Text Word] OR "ascorbate sodium "[Text Word] OR "ascorbic acid "[Text Word] OR "ascorbic acid potassium salt "[Text Word] OR "ascorbicap "[Text Word] OR "ascorbicin "[Text Word] OR "ascorbico "[Text Word] OR "ascorbin "[Text Word] OR "ascorbina "[Text Word] OR "ascorbinic acid "[Text Word] OR "ascorbit "[Text Word] OR "ascorbite "[Text Word] OR "ascorbitol "[Text Word] OR "ascorbivit "[Text Word] OR "ascorbivite "[Text Word] OR "ascorbone "[Text Word] OR "ascorbutina "[Text Word]

OR "ascorbyl "[Text Word] OR "ascorbyn "[Text Word] OR "ascorcee "[Text Word] OR "ascorgil "[Text Word] OR "ascorin "[Text Word] OR "ascormin "[Text Word] OR "ascorteal "[Text Word] OR "ascorval "[Text Word] OR "ascorvel "[Text Word] OR "ascorvit "[Text Word] OR "ascorvite "[Text Word] OR "ascorvitina "[Text Word] OR "askorbin "[Text Word] OR "austrovit c "[Text Word] OR "austrovite c "[Text Word] OR "bentavit c "[Text Word] OR "bentavite c "[Text Word] OR "c crivit "[Text Word] OR "c ine "[Text Word] OR "c level "[Text Word] OR "c lisa "[Text Word] OR "c long "[Text Word] OR "c monovit "[Text Word] OR "c monovite "[Text Word] OR "c prana "[Text Word] OR "c rivitin "[Text Word] OR "c rivitine "[Text Word] OR "c sol "[Text Word] OR "c tamin "[Text Word] OR "c tamine "[Text Word] OR "c tonic "[Text Word] OR "c tron "[Text Word] OR "c vescent "[Text Word] OR "c vicotrat "[Text Word] OR "c vicotrate "[Text Word] OR "c vimin "[Text Word] OR "c vimine "[Text Word] OR "c vit "[Text Word] OR 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OR "cevitamin "[Text Word] OR "cevitaminic acid "[Text Word] OR "cevitaminum kolin "[Text Word] OR "cevitan "[Text Word] OR "cevite "[Text Word] OR "cevitex "[Text Word] OR "cevitil "[Text Word] OR "cevitol "[Text Word] OR "cewin "[Text Word] OR "chewcee "[Text Word] OR "chivibit c "[Text Word] OR "ci drol "[Text Word] OR "ciamin "[Text Word] OR "ciamina ormo "[Text Word] OR "ciergin "[Text Word] OR "cifilina "[Text Word] OR "cipca "[Text Word] OR "cisir "[Text Word] OR "citamino "[Text Word] OR "cith "[Text Word] OR "citoascorbina "[Text Word] OR "citoxyl "[Text Word] OR "citran "[Text Word] OR "citravite "[Text Word] OR "citritabs "[Text Word] OR "citrovitamina "[Text Word] OR "civigor "[Text Word] OR "civitin "[Text Word] OR "civitine "[Text Word] OR "co biagini "[Text Word] OR "concemin "[Text Word] OR "cortalex "[Text Word] OR "d ascorbic acid "[Text Word] OR "d xyloascorbic acid "[Text Word] OR "dagrascorbin "[Text Word] OR "dagravit c "[Text Word] OR "dancimin c "[Text Word] OR 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OR "scottavit c "[Text Word] OR "scottavite c "[Text Word] OR "secorbate "[Text Word] OR "sevalin "[Text Word] OR "sigmavit c "[Text Word] OR "sigmavite c "[Text Word] OR "sodascorbate "[Text Word] OR "sodium ascorbate "[Text Word] OR "sodium l ascorbate "[Text Word] OR

"sweetcee "[Text Word] OR "synum c "[Text Word] OR "take-c "[Text Word] OR "tanvimil-c "[Text Word] OR "testascorbic "[Text Word] OR "ucemine c "[Text Word] OR "upsa c "[Text Word] OR "upsa-c "[Text Word] OR "upsavit "[Text Word] OR "vagi-c "[Text Word] OR "vi ci sin "[Text Word] OR "vi dom c "[Text Word] OR "vi-c 500 "[Text Word] OR "vicef "[Text Word] OR "vicelat "[Text Word] OR "vicetrin "[Text Word] OR "vici monico "[Text Word] OR "viciman "[Text Word] OR "vicin "[Text Word] OR "vicitina "[Text Word] OR "vicon "[Text Word] OR "viforcit "[Text Word] OR "viforcite "[Text Word] OR "viscorin "[Text Word] OR "viscorine "[Text Word] OR "vita-cedol orange "[Text Word] OR "vita-gem c "[Text Word] OR "vitac "[Text Word] OR "vitace "[Text Word] OR "vitacee "[Text Word] OR "vitaci "[Text Word] OR "vitacimin "[Text Word] OR "vitacimine "[Text Word] OR "vitacin "[Text Word] OR "vitacine "[Text Word] OR "vitamin C "[Text Word] OR "vitamin c 1 "[Text Word] OR "vitaplex c "[Text Word] OR "vitapric "[Text Word] OR "vitapur c "[Text Word] OR "vitasan c "[Text Word] OR "vitascorbin "[Text Word] OR "vitascorbine "[Text Word] OR "vitascorbol "[Text Word] OR "vitascorbol 500 "[Text Word] OR "vitelix c "[Text Word] OR "vitocee "[Text Word] OR "vorange "[Text Word] OR "wandervit c "[Text Word] OR "wandervite c "[Text Word] OR "witamina c "[Text Word] OR "xitix "[Text Word] OR "xon-ce "[Text Word] OR "xyloascorbic acid "[Text Word])) Filters: Meta-Analysis, Review, Systematic Review
Scopus
)TITLE ("allescorb" OR "antiscorbutic vitamin" OR "arcavit c" OR "arcavite c" OR "arkovital c" OR "ascelat" OR "ascofar" OR "ascomed" OR "asconvita" OR "ascor" OR "ascor l 500" OR "ascorbate" OR "ascorbate sodium" OR "ascorbic acid" OR "ascorbic acid potassium salt" OR "ascorbicap" OR "ascorbicin" OR "ascorbico" OR "ascorbin" OR "ascorbina" OR "ascorbinic acid" OR "ascorbit" OR "ascorbite" OR "ascorbitol" OR "ascorbivit" OR "ascorbivite" OR "ascorbone" OR "ascorbutina" OR "ascorbyl" OR "ascorbyn" OR "ascorcee" OR "ascorgil" OR "ascorin" OR "ascormin" OR "ascorteal" OR "ascorval" OR "ascorvel" OR "ascorvit" OR "ascorvite" OR "ascorvitina" OR "askorbin" OR "austrovit c" OR "austrovite c" OR "bentavit c" OR "bentavite c" OR "c crivit" OR "c ine" OR "c level" OR "c lisa" OR "c long" OR "c monovit" OR "c monovite" OR "c prana" OR "c rivitin" OR "c rivitine" OR "c sol" OR "c tamin" OR "c tamine" OR "c tonic" OR "c tron" OR "c vescent" OR "c vicotrat" OR "c vicotrate" OR "c vimin" OR "c vimine" OR "c vit" OR "c vita" OR "c vital" OR "c vitam" OR "c vite" OR "c-tard" OR "c-vimin" OR "c-will" OR "cantan" OR "cantaxin" OR "catavin c" OR "ce arom" OR "ce limo" OR "ce major" OR "ce quin" OR "ce quine" OR "ce vi sol" OR "ce vita" OR "ce vitan" OR "ce-vi-sol" OR "cebetate" OR "cebicure" OR "cebiolon" OR "cebion" OR "cebione" OR "cecap" OR "cecon" OR "cecon drops" OR "cecon solution" OR "cecone" OR "cecorbin" OR "cecorbine" OR "cecorbyl" OR "cecorbyle" OR "cecrisina" OR "cedon" OR "cedone" OR "cedoxon" OR "cedoxone" OR "cee-500" OR "ceevifil" OR "cegiolan" OR "celaskon" OR "celaskone" OR "celin" OR "celine" OR "cenetone" OR "cenol" OR "cenolate" OR "cequinyl" OR "cereon" OR "cergona" OR "cescorbat" OR "cetamican" OR "cetamid" OR "cetamin knoll australia" OR "cetamine" OR "cetamine knoll australia" OR "cetebe" OR "ceterapion" OR "ceterapione" OR "cetrinets" OR "cevalin" OR "cevaline" OR "cevatine" OR "cevex" OR "cevibram" OR "cevigal" OR "cevigen" OR "cevigol" OR "cevikap" OR "cevilat" OR "cevimin" OR "cevimine" OR "cevisol" OR "cevit" OR "cevita" OR "cevitamic acid" OR "cevitamin" OR "cevitaminic acid" OR "cevitaminum kolin" OR "cevitan" OR "cevite" OR "cevitex" OR "cevitil" OR "cevitol" OR "cewin" OR "chewcee" OR "chivibit c" OR "ci drol" OR "ciamin" OR "ciamina ormo" OR "ciergin" OR "cifilina" OR "cipca" OR "cisir" OR "citamino" OR "cith" OR "citoascorbina" OR "citoxyl" OR "citran" OR "citravite" OR "citritabs" OR "citrovitamina" OR "civigor" OR "civitin" OR "civitine" OR "co biagini" OR "concemin" OR "cortalex" OR "d ascorbic acid" OR "d xyloascorbic acid" OR "dagrascorbin" OR "dagravit c" OR "dancimin c" OR "davitamon c" OR "dayvital" OR "delo c" OR "difvitamin c" OR "dropice" OR "dumovit c" OR "dumovite c" OR "e ascorbic acid" OR "e xyloascorbic acid" OR "erftamin c" OR "erftamine c" OR "esuron" OR "esurvit" OR "esurvite" OR "flavettes" OR "godabion c" OR "gregovite c" OR "hicee" OR "hybrin" OR "ido c" OR "ikacee" OR "inovitan c" OR "irocevit" OR "irocevite" OR "jarexin" OR "jarexine" OR "l 3 keto hexuronic acid lactone" OR "l ascorbic acid" OR "l xylo ascorbic acid" OR "l xyloascorbic acid" OR "lacivit" OR "lacivite" OR "laroscorbine" OR "leder c" OR "leder-c" OR "lemascorb" OR "levo ascorbate" OR "levo ascorbic acid" OR "limcee" OR "limo ce" OR "liqui cee" OR "mega-c/a plus" OR "myascorbin" OR "natrascorb" OR "novo ascorbic" OR "nybadol" OR "paa 500" OR "parkovit c" OR "pascorbin" OR "pharmascorbine" OR "pharmatovit c" OR "pharmatovite c" OR "planavit c" OR "planavite c" OR "plivit c" OR "plivite c" OR "potassium ascorbate" OR "pro-c" OR "proscorbin" OR "proscorbine" OR "redoxon" OR "redoxon c" OR "redoxon forte" OR "ribena" OR "scorbacid" OR "scorbacide" OR "scorbettes" OR "scorbex" OR "scorbin c" OR "scorbitol" OR "scorbumine" OR "scottavit c" OR "scottavite c" OR "secorbate" OR "sevalin" OR "sigmavit c" OR "sigmavite c" OR "sodascorbate" OR "sodium ascorbate" OR "sodium l ascorbate" OR "sweetcee" OR "synum c" OR "take-c" OR "tanvimil-c" OR "testascorbic" OR "ucemine c" OR "upsa c" OR "upsa-c" OR "upsavit" OR "vagi-c" OR "vi ci sin" OR "vi dom c" OR "vi-c 500" OR "vicef" OR "vicelat" OR "vicetrin" OR "vici monico" OR "viciman" OR "vicin" OR "vicitina" OR "vicon" OR "viforcit" OR "viforcite" OR "viscorin" OR "viscorine" OR "vita-cedol orange" OR "vita-gem c" OR "vitac" OR "vitace" OR "vitacee" OR "vitaci" OR "vitacimin" OR "vitacimine" OR "vitacin" OR "vitacine" OR "vitamin C" OR "vitamin c 1" OR "vitaplex c" OR "vitapric" OR "vitapur c" OR "vitasan c" OR "vitascorbin" OR "vitascorbine" OR "vitascorbol" OR "vitascorbol 500" OR "vitelix c" OR "vitocee" OR "vorange" OR "wandervit c" OR "wandervite c" OR "witamina c" OR "xitix"

OR "xon-ce" OR "xyloascorbic acid") AND TITLE ("systematic review" OR "review, systematic" OR "systematic review" OR "meta analysis" OR "analysis, meta" OR "meta analysis" OR "meta-analysis" OR "metaanalysis" OR review)(
The Web of Science
"coronavirus disease 2019" OR "2019 novel coronavirus disease" OR "2019 novel coronavirus epidemic" OR "2019 novel coronavirus infection" OR "2019-nCoV disease" OR "2019-nCoV infection" OR "COVID" OR "COVID 19" OR "COVID 2019" OR "COVID-10" OR "COVID-19" OR "COVID19" OR "SARS coronavirus 2 infection" OR "SARS-CoV-2 disease" OR "SARS-CoV-2 infection" OR "SARS-CoV2 disease" OR "SARS-CoV2 infection" OR "SARSCoV2 disease" OR "SARSCoV2 infection" OR "Wuhan coronavirus disease" OR "Wuhan coronavirus infection" OR "coronavirus disease 2" OR "coronavirus disease 2010" OR "coronavirus disease 2019" OR "coronavirus disease-19" OR "coronavirus infection 2019" OR "nCoV 2019 disease" OR "nCoV 2019 infection" OR "novel coronavirus 2019 disease" OR "novel coronavirus 2019 infection" OR "novel coronavirus disease 2019" OR "novel coronavirus infection 2019" OR "paucisymptomatic coronavirus disease 2019" OR "severe acute respiratory syndrome 2" OR "severe acute respiratory syndrome CoV-2 infection" OR "severe acute respiratory syndrome coronavirus 2 infection" OR "severe acute respiratory syndrome coronavirus 2019 infection" (Topic) and "ascorbic acid" OR "acidum ascorbicum" OR "acidalia" OR "ademex" OR "afj c" OR "aurumina" OR "allercare" OR "alloscore" OR "antiscorbutic vitamin" OR "arcavit c" OR "arcavite c" OR "arkovital c" OR "ascolat" OR "ascofer" OR "alcomed" OR "abscondita" OR "ascot" OR "ascot l 500" OR "ascorbate" OR "ascorbate sodium" OR "ascorbic acid" OR "ascorbic acid potassium salt" OR "ascorbicus" OR "ascorbici" OR "ascorbic" OR "ascorbic" OR "ascorbine" OR "ascorbinic acid" OR "ascorbic" OR "ascorbate" OR "ascorbico" OR "ascorbinic" OR "ascorbinate" OR "ascorbine" OR "ascorbutic" OR "ascorbyl" OR "ascorbyl" OR "accordee" OR "ascorbil" OR "asporin" OR "ascorbin" OR "ascometal" OR "ascoral" OR "ascorbyl" OR "ascovit" OR "ascorbite" OR "ascorvitina" OR "ascorbin" OR "austrovit c" OR "austrovite c" OR "bentavit c" OR "bentavite c" OR "c crivit" OR "c ine" OR "c level" OR "c lisa" OR "c long" OR "c monovit" OR "c monovite" OR "c prana" OR "c rivitin" OR "c rivitine" OR "c sol" OR "c tamin" OR "c tamine" OR "c tonic" OR "c tron" OR "c vescent" OR "c vicotrat" OR "c vicotrate" OR "c vimin" OR "c vimine" OR "c vit" OR "c vita" OR "c vital" OR "c vitam" OR "c vite" OR "c-tard" OR "c-vimin" OR "c-will" OR "cartan" OR "caytaxin" OR "catavin c" OR "ce arom" OR "ce limo" OR "ce major" OR "ce quin" OR "ce quine" OR "ce vi sol" OR "ce vita" OR "ce vitan" OR "ce-vi-sol" OR "celerate" OR "cubicure" OR "crebillon" OR "cerion" OR "cerione" OR "cecal" OR "cercon" OR "cercon drops" OR "cercon solution" OR "cetone" OR "cecropin" OR "cycombine" OR "cemobyl" OR "cecorbyle" OR "cecropina" OR "codon" OR "cetone" OR "cedomon" OR "cadoxene" OR "cee-500" OR "cervidil" OR "coriolan" OR "celation" OR "celaskon" OR "colin" OR "celine" OR "centone" OR "cendl" OR "canolate" OR "coquinal" OR "cercon" OR "cergowa" OR "cescorbat" OR "ceramical" OR "ceramid" OR "cetamin knoll australia" OR "catamine" OR "catamine knoll australia" OR "cetene" OR "celeration" OR "ceterapione" OR "clarinets" OR "cesalin" OR "cevadine" OR "cevadine" OR "cedex" OR "cervigram" OR "cevical" OR "cervigen" OR "cevikol" OR "cevikalp" OR "civilta" OR "cedimin" OR "cevimeline" OR "cevikol" OR "cavit" OR "civita" OR "cevitamic acid" OR "cevitamic" OR "cevitaminic acid" OR "cevitaminum kolin" OR "cevital" OR "celite" OR "cavites" OR "cevital" OR "cevital" OR "cetin" OR "cherche" OR "chivibit c" OR "ci drol" OR "ciamis" OR "ciamina ormo" OR "cherlin" OR "civilian" OR "circa" OR "cispr" OR "citadino" OR "cite" OR "citoascorbina" OR "cytosyl" OR "citral" OR "citravit" OR "citritase" OR "citrovitamina" OR "caligor" OR "cavitin" OR "covitine" OR "co biagini" OR "conceming" OR "cortaflex" OR "d ascorbic acid" OR "d xyloascorbic acid" OR "dagrascorbin" OR "dagravit c" OR "dancimin c" OR "davitamon c" OR "devital" OR "delo c" OR "difvitamin c" OR "dropicle" OR "dumovit c" OR "dumovite c" OR "e ascorbic acid" OR "e xyloascorbic acid" OR "erftamin c" OR "erftamine c" OR "estron" OR "esurvey" OR "eservice" OR "florettes" OR "godabion c" OR "gregovite c" OR "higee" OR "hybrid" OR "ido c" OR "inacee" OR "inovitan c" OR "irovit" OR "irocevite" OR "javelin" OR "javeline" OR "l 3 keto hexuronic acid lactone" OR "l ascorbic acid" OR "l xylo ascorbic acid" OR "l xyloascorbic acid" OR "lacivita" OR "lactivite" OR "laroscorbine" OR "leder c" OR "leder-c" OR "lewasorb" OR "levo ascorbate" OR "levo ascorbic acid" OR "limnee" OR "limo ce" OR "liqui cee" OR "mega-c/a plus" OR "mlascorbic" OR "nutrasorb" OR "novo ascorbic" OR "nyadol" OR "paa 500" OR "parkovit c" OR "pascorbic" OR "pharmascorbine" OR "pharmatovit c" OR "pharmatovite c" OR "planavit c" OR "planavite c" OR "plivit c" OR "plivite c" OR "potassium ascorbate" OR "pro-c" OR "proscorpio" OR "proscoliine" OR "redoxin" OR "redoxin c" OR "redoxin forte" OR "ribera" OR "sorbacid" OR "sorbamide" OR "sorbettes" OR "sorbex" OR "scorbin c" OR "sorbitol" OR "sorbamine" OR "scottavit c" OR "scottavite c" OR "scorbate" OR "secalin" OR "sigmavit c" OR "sigmavite c" OR "sodascorbate" OR "sodium ascorbate" OR "sodium l ascorbate" OR "sweetser" OR "synum c" OR "take-c" OR "tanvimil-c" OR "testascorbic" OR "ucemine c" OR "upsa c" OR "upsa-c" OR "upsalite" OR "vagi-c" OR "vi ci sin" OR "vi dom c" OR "vi-c 500" OR "vices" OR "viallat" OR "victorin" OR "vici monico" OR "vicilan" OR "vicia" OR "vicetina" OR "vicon" OR "vaforit" OR "viforcite" OR "viscosin" OR "vincorine" OR "vita-cedol orange" OR "vita-gem c" OR "vital" OR "vitale" OR "vitaceae" OR "vitali" OR "vitaimin" OR "vitacimin" OR "vitamin" OR "vitamine" OR "vitamin C" OR "vitamin c 1" OR "vitaplex c" OR "viatoric" OR "vitapur c" OR "vitasan c" OR "vitascorbin" OR "vitascorbine" OR "vitascorbol" OR "vitascorbol

500" OR "vitelix c" OR "vitaceae" OR "vorgange" OR "wandervit c" OR "wandervite c" OR "witamina c" OR "xitinx" OR "xon-ce" OR "xyloascorbic acid" AND "systematic review" OR "review, systematic" OR "systematic review" OR "meta analysis" OR "analysis, meta" OR "meta analysis" OR "meta-analysis" OR "metaanalysis" OR review

Supplementary file 2- The details of each including a systematic review in the current umbrella review.

Number	DOI	Please note that	Number of studies	Number of participents	MD	95% CI	I^2	P-value		
4	10.3390/nu14194217	Included studies are the same in Num. 4 and 6 but have different results	8	1497 (512/985)	1.12	(-1.16) - 3.4	98%	0.34	No difference	
7	10.1016/j.dsx.2021.102324	N/A	4	338 (170/168)	-0.23	(-1.04) - 0.58	92%	< 0.00001	No difference	
8	10.1016/j.ctim.2021.102797	N/A	4	298 (140/158)	0.005	(-1.11) - 1.29	N/A	0.993	No difference	