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ANTI-SARS-COV PROPERTY OF YASTHIMADHU CONSTITUENT AND ITS EMPIRICAL DOCUMENTATION FROM AYURVEDA TEXT

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ABSTRACT

COVID-19 is notified as a public health crisis of international concern by the World Health Organization. Several clinical, genetic and epidemiological features of COVID-19 resemble SARS-CoV. There is need to search herbal antiviral agents having efficacy against a broad spectrum of viruses especially against SARS-CoV. Glycyrrhiza Glabra (*Yasthimadhu*) has found same documented efficacy.

The aim of this review is to systematically assess the evidence from various experimental and other studies for the efficacy of GG in the treatment of SARS-CoV. Also, to addresses the modern evidences for this activity and establishes the relationship amongst classical and modern aspects.

The search for suitable papers in Pub-Med was carried out. Ayurvedic classics records on the in ancient *Ayurveda* books were searched. In *Charaka*, 194 references were found out of which 70 relevant were taken for analysis. In *Sushrut Samhita*, total 174 references were found. Among which, 49 were taken for analysis. Seven *Nighantus* were searched out. Documented studies show the GG has efficacy in treatment of SARS-CoV. Also has potential for the therapy and prophylaxis against SARS-CoV -2.

KEYWORDS: *Glycyrrhiza Glabra, Yasthimadhu, SARS-CoV*

INTRODUCTION

Globally, as of 4:59pm, 1st April,2022, there have been 486,761,597 confirmed cases of COVID-19, including 6,142,735 deaths, reported to WHO[1].

On 30 January 2020, it was notified as a public health crisis of international concern by the World Health Organization [2]

The categorisation of novel coronavirus (i.e., wide-reaching in number, single-stranded ribonucleic acid virus of the subfamily *Orthocoronavirinae*, family *Coronaviridae* order *Nidovirales*), which is now split up in alpha, beta, delta and gamma. Alpha and beta coronavirus amidst these four, are related to human health affairs [3]

The ongoing unfolding of corona viruses at consistent intermission shows a notable danger to human health and economy.[4]

Several clinical, genetic and epidemiological features of COVID-19 resemble SARS-CoV &MERS

Among various antiviral herbal agents, Glycyrrhizin (component from GG) was also reported to be effective as Antiviral agents against a broad spectrum of viruses, including herpes viruses, flaviviruses, SARS coronavirus (SARS-CoV) and human immunodeficiency virus because of having bioactive compounds like triterpene glycoside glycyrrhizic acid (glycyrrhizin, GL) and its aglycone 18 beta glycyrrhetinic acid (GLA).[5]

Historically, when the outbreak started, Ayurvedic medicine approaches including oral administration of preventive herb Glycyrrhiza Glabra (GG), was recommended for prevention and treatment. For example, in 2003, GG derivative were found more potent as antiviral against severe acute respiratory syndrome (SARS-CoV).

In Ayurvedic classics like *Charaka samhita* and *Sushruta samhita,* upper respiratory tract viral infection is described under *Pranvaha srotas dusti* whose treatment is mentioned as *Shwasa roga*.

Ayurveda medicinal plant *G. Glabra* can be helpful in the management of this COVID-19 in many ways, as prophylactic, palliative, curative and supportive and undoubtedly it helps to improve the longevity of life.

Taking this context into consideration, the main goal of this work was to perform a narrative review highlighting historical and research evidence on GG in SARS-COV-2, in order to summarize the results of the numerous studies and trials, and try to clarify efficacy of licorice as antiviral agent against SARS-CoV which might have the potential for the amelioration of symptoms/ prophylaxis and treatment of present factor SARS-CoV-2 in COVID-19.

The aim of this review is to systematically assess the evidence from various experimental and other studies for the efficacy of GG in the treatment of SARS-CoV. Also to addresses the modern evidences for this activity and establishes the relationship amongst classical and modern aspects.

Therefore, in this review, we show up research documentation on GG that exhibited favorable efficacy as antiviral agent against SARS-Co V which might have the prospects for the cure and prophylaxis of SARS-CoV-2.

MATERIALS AND METHODS

The study design followed the guidelines of the Narrative review i.e. SENRA guidelines.

METHOD

Search strategy

The search for suitable papers in Pub-Med was carried out. The ultimate goal of this search was to explore articles that investigated the anti-viral potential of GG and its molecules against SARS-CO viruses. Additional papers were included in our

collection after surveying the references from the selected articles.

Historical classics records on the Anti-Viral property in ancient *Ayurveda* books were searched, The search for suitable inferences in NIIMH was carried out using keywords: "*Yashtimadhu*" and "*Madhuk*". Search was carried out for YM using clinical indication, *dosha* specific indications, dosage form, and dose. Retrieval strategy differed among the above three types of data. The Historic type of data was based on mainly manual retrieval of ancient books of Ayurveda i.e *Charaka & Sushrut Samhita*. The list of literature retrieved was determined by discussion among all authors.

Study selection

The shortlisted, relevant studies and relevant inferences from *Samhita* were independently assessed by the authors of this study.

Results

In *Charaka*, 194 references were found out of which 70 relevant were taken for analysis. In *Sushrut Samhita*, total 174 references were found. Among which, 49 were taken for analysis. Seven *Nighantus* were searched out. *Pana* as oral dosage form used is found more. *Pitta* and associated *dosha shaman, Kasa-shwas-jwar-pratishyaya pacifying & vrana ropana* properties were found from Ayurvedic literature. Experimental studies, in-silico analysis and other studies are detailed in table 1.

DISCUSSION AND CONCLUSION

Reviewed drug from various studies was analyzed for its potential use for the management of coronavirus infections and summarized it in following 3 sections:

1. **In-vitro studies of Glycyrrhizin against SARS-CoV**

Cinatl J et al evaluated the anti-viral potential of ribavirin, 6-azauridine, pyrazofurin, mycophenolic acid, and glycyrrhizin against the SARS-CoV isolates from two diagnosed SARS patient. The Vero cells were infected with isolates and visually inspected for cytopathogenicity induced by virus after 72-96 hours. The cytotoxicity was also measured by MMT cell proliferative assay. The result showed that glycyrrhizin was the most potent inhibitor of SARS-CoV in Vero cells with selectivity index 67. Moreover, glycyrrhizin inhibited adsorption and penetration virus, which are the early stages of the replicative cycle. The glycyrrhizin was less effective when added during adsorption (EC_{50} 600mg/L) than after virus adsorption (EC_{50} 2400mg/L). The high effectiveness was detected when added both during and after the adsorption period (EC_{50} 300mg/L). Next, the glycyrrhizin was assessed for its effect on virus replication, interestingly the cells treated with glycyrrhizin (1000 mg/L) showed lower expression of viral antigensand in higher concentrations (4000 mg/L) completely blocked replication of the virus. Thus, glycyrrhizin showed effective against SARS-CoV as potent inhibitor of adsorption and penetration virus in Vero cells and also effectively inhibited virus proliferation. [6]

Chen et al studied the antiviral property of bioactive compounds using ten isolates of SARS coronavirus from 10 different SARS patients. The main bioactive compounds, namely, baicalin (derived from *Scutellariabaicalensis*), glycyrrhizin (from *Glycyrrhizauralensis*), chlorogenic acid (from *Floslonicerae*) and artesunate (from *Artemisia apiacea*) were investigated in the present study along with synthetic anti-viral drugs. The initial anti-viral screening was conducted in 96 well microtitre plates seeded with foetal rhesus kidney -4 cells and also compared with Vero-E6 cell lines. The compounds which are found to have inhibitory activity were tested against remaining 9 isolates. It was found that

glycyrrhizin was moeactive at 72h in Vero-E6 cell and not in fRhK-4 cells. [7]

Hoever et al determined the efficacy of 15 derivatives of glycyrrhizin on SARS-CoVisolated from respiratory specimen of SARS patient and cultivated on Vero cells. The immune-histochemical staining, Visual CPE assay and cytotoxicity determined assessed using MTT assay. Out of 15 derivatives7 inhibited SARS-CoV replication at lower concentrations compared to GL. Importantly, *N*-acetylgycosaminatedGL increased the anti SARS-CoV activity about 9 times compared to GL. It also inhibited SARS-CoV replication at an EC50 of 40 μM and the selectivity index (SI) is >75. At a concentration of 500 μM, no cytopathic effect (CPE) was detected. The β-D-glucuropyranosyl-(1->2)-β-D-glucuronopyranoside analogue of GL with the changed carbohydrate part, heterocyclic amides and of GL, and the acyl hydrizidewere active against SARS-CoV with an EC50 ranging from 5 μM up to 50 μM. However, these compounds presented a high cytotoxicity.In nutshell, this study demonstrates that modification of GL may lead to novel anti-SARS-CoV drugs with increased activity.[8]

Wu et al screened existing drugs, natural products and synthetic compounds to identify anti-SARS agents by cell based assay using SARS virus and Vero E6 cells. The agents tested were nearly 200 FDA approved drugs, > 8000 synthetic compounds, nearly 1000 traditional Chinese herbs and 500 protease inhibitors. The primary screening for anti-viral effect were determined on the prevention of the SARS-virus mediated cytopathic effect. Those agents which had anti-viral activity on primary screening were further confirmed with additional studies cytotoxicity, immunofluorenscence ELISA, Western blot analysis, flow cytometry on viral protein expression with SARS-CoV-spike protein specific monoclonal antibodies, and protease inhibition. Glycyrrhizin, Aescin and Reserpine were tested further, since these compounds used clinically their related compounds could also be active against SARS-Cov. The 15 compounds related to Glycyrrhizin and Aescin and six compounds related to Reserpine were evaluated for anti-viral activity through a cell-based assay, 10 of the 21compounds showed activities against SARS-CoV. Among them, four compoundsare derivatives of Glycyrrhizin and Aescin, and all six derivatives of Reserpine showed activities toward SARS-CoV at <100 µM. [9]

Lukas van de Sand, Maren Bormann et al., carried out the study on the antiviral activity of glycyrrhizin against SARS-CoV-2 which shows that Glycyrrhizin effectively Inhibits SARS-CoV-2 replication by inhibiting the Viral Main Protease. In first phase, Antiviral activity of licorice root extract against SARS-CoV-2 (in vitro), showed antiviral effects even at a subtoxic concentration. This concentration is lower than the normal consuming dilution. In 2nd phase, effective inhibition of SARS-Cov-2 replication by Glycyrrhizin at a concentration of 0.5 mg/mL (combined pre- and post-entry conditions) or 1 mg/mL (post-entry conditions) was found. In 3rd phase, quantitative analysis of antiviral activity of glycyrrhizin against SARS-CoV-2 replication on RNA level was investigated which demonstrate a high antiviral activity against SARS-CoV-2 and completely inhibited the viral replication at subtoxic concentration. In 4th phase, inhibition of the SARS-CoV-2 Main Protease, by Glycyrrhizin leading to block of SARS-CoV-2 replication. [10]

Pruthvi gowda et al studied that *glycyrrhizin* prevents SARS-CoV -2S1 and Orf3a induced high mobility group box 1 (HMGB1) release and inhibits viral replication. They found that glycyrrhizin prevents S-RBD and Orf3a mediated death and capase -1 activation. It prevents cytokine release from macrophages cultivated in BEAS-2B conditioned medium. *Glycyrrhizin* diminishes ferritin release in macrophages cultivated in conditioned media from BEAS-2B cells transfected with S-RBD and Orf3a. glycyrrhizin also inhibits SAR-CoV-2 replication in Vero E6 cells.[11]

2. Ayurveda description of properties, therapeutic uses of *Yasthimadhu*

Acharya Charka - *Yashtimadhu* was used in different forms like *churna* (powder), *avleha* (medicated jam), decoction, cold infusion internally. At various places enema and purgation by *yashtimadhu* is prescribed in different ailments. *Kanthya* (improves voice or relieves sore throat), *jwarahar* (relieves fever), *shwasaroghara* (relieves respiratory disorder), *dahaprashmak* (body heat lowering), *Kasahara* (relieves cough), *vishahar*(treating poisonings), *varnya* (improves complexion) effect are described. It is also shown as *ropaniya* (natural healer).

As we see the relevant references of oral use of *yashtimadhu* it is used in disease of respiratory tract like sore or scratchy throat, sneezing, cough, breathlessness, fever associated with this. We found All these symptoms in common cold which is caused by various viruses like rhinovirus, coronavirus, RSV and parainfluenza etc. So, we can analyze according to the references that *yashtimadhu* possess antiviral properties. The symptoms like *jwara* with *kasa* can be in immunocompromised states like TB in patients of HIV positive patients.

It is mostly used in predominancy of *kapha* and *pitta dosha*. In aggravated *pitta dosha* conditions it is used in *ghrita* form in dose of 2-5 tola i.e. 24-60gms.

Sushrut Samhita- It is described that *yashtimadhu* has wound healing properties. It is used for local application (*lepa*, oil)in various type wounds like in diabetic wounds, non-healing wounds and also used after nasoplasty. Due to its *rakta pitta shamak* properties it is used in disease related to these doshas like *raktapitta, jwara*, burning sensation etc. for this purpose it is used internally in decoction form. It is available in different forms like *sarivadi Kashaya, ambasthadi, utpaladi, nygrodhadi* etc. *vidangatandula yoga* of it is used for increasing intellectual power and for worming. *Yashtimadhu* is described in treatment of *kasa, swasa and pratishyaya*. It is used orally and through nasal route (*nasya*). For cough it is used with *vamshalochana* and *shunthi*.

It is described mainly as *pitta* and *rakta* pacifying. Its use in symptoms like fever, cough, running nose etc. describes that it is beneficial in respiratory tract infections along with soothing and anti-inflammatory effect.

In *Nighantus* like *Abhinandanmanjari, Kaiyadeva Nighantu, Dhanwantri Nighantu* etc. It is described as having cooling property (*sheetaveerya*). In *Abhinandanmanjari* it is included in *madanavarga* and different synonyms like *madhukam, madhuyashti, yashtika, madhurdrava* etc. and it is described as useful in *daha, pitta, rakta*disease and *jwara*.

In *Kaiyadeva Nighantu* it is mentioned under *aushadivarga*. It is described sweet in taste and with *guru* and *snigdha* property. It is useful in *pitta, vata* and blood related conditions. It is described in conditions like poisoning, vomiting, inflammation, wounds etc. it is described as good for vision, hairs and voice etc.

In *Dhanwantri Nighantu* it is described under *guduchyadivarga*. Different synonyms are given for it like *yashti, yashtimadhu, madhursrava* etc. due to its *madhur, sheet guna* it is used in *piita* ailments. It is useful in vomiting, emaciation.
In *Bhavprakasha Nighantu* it is mentioned under *haritakyadivarga*. It is described as *balavranakrita*, aphrodisiac, *swarya* etc. In *Madanpala Nighantu* it is described under *abhyadivarga*. Synonyms like *klethakam, madhulika, yashti* and *Jalaja* are given to *yashtimadhu*. It is described as *balya*.
In *Madandi Nighantu* it is described under *Prathama khanda*. *Sthalajam, jalajam, yashtiyahava*, *kleetanakam*. Its taste is described as sweet and somewhat bitter. In *shosha, trishna* and *vrana* it is prescribed.
In *Siddhamantra* it is described as *vatapittahara* and *vatakaphahara*. In *ShodalaNighantu* it is described under *guduchyadivarga*. Synonyms like *madhuyastiyam, madhursrava, klethaka, klethatanam*, *madhulika, madhuparni*. It is described as *virasa* (tasteless). It corrects weakness.

3. Miscellanous

Manjunath B joshi et al studied the modulation of neutrophil dys(function) by ayurvedic herbs and its potential influence on SARS-CoV-2 infection. They found that all these ayurvedic herbs possess immunomodulatory, anti-microbial, anti-oxidant and anti-inflammatory properties. They demonstrated immunomodulatory properties of various ayurvedic herbs including *tinosporiacordifolia, withania somnifera, asparagus racemosus, ocimum sanctum, zingiber officinale, Cinnamomum zeylanicum, emblica officinalis, Andrographis panniculata, Phyllanthus niruri, piper nigrum, piper longum, curcuma longa, glycyrrhiza glabra, adhatoda vasica, datura metal, allium sativum*and *alstonia scholaris* in treating infectious and non-infectious disease. Out of these active components of *glycyrrhiza* such as glabridin, gabrin, glabrol, glabrene, hispaglabridin A, hispaglabridin B, 40-methylglabridin and 3-hydroxyglabrol exhibited in vitro antimicrobial activity. Its bioactive component such as ribavirin, 6- azauridine, pyraziofurin, mycophenolic acid and *glycyrrhizin* against SARS virus and *glycyrrhizin* has also been used for management of HIV-1 and chronic hepatitis C virus. In vivo 400mg/kg per oral for 8 days in male Wastar rats were given and it was observed that it has antimicrobial, immunomodulatory, antithrombotic, antitussive, expectorant, antimicrobial, antioxidant and immunomodulatory properties. *Glycyrrhizin* acid inhibits L-1 β, IL-3, IL-5,IL-6, IL-10, IL-12, IL-13, Eotaxin and TNF-α secreted by LPS-induced RAW264.7 cells.[12]
It can be concluded that GG has efficacy in treatment and prophylaxis against SARS-CoV as per documented studies.

AUTHORS	TITLE OF THE STUDY	PUBLICATION YEAR		POPULATION/ STUDY METHODS	INTERVENTION	OUTCOME
Cinatl J, Morgenstern B, Bauer G, Chandra P, Rabenau H, Doerr HW.	Glycyrrhizin, an active component of liquorice roots, and replication of SARS-associated coronavirus	2003	LANCET	two clinical isolates of coronavirus (FFM-1 and FFM-2) from patients with SARS	glycyrrhizin	**EC50 (µg/ml) at 48 h-** ibavirin, 6-azauridine, pyrazofurin, mycophenolic acid **EC50 (µg/ml) at 72 h-** glycyrrhizin was the most active in inhibiting replication of the SARS-associated virus **CC50 (µg/ml)-** The most potent inhibitor of SARS-CV replication in Vero cells was glycyrrhizin, which had a selectivity index of 67
Chen F, Chan KH, Jiang Y, Kao RY, Lu HT, Fan KW, Cheng VC, Tsui WH, Hung IF, Lee TS, Guan Y, Peiris JS, Yuen KY.	In vitro susceptibility of 10 clinical isolates of SARS coronavirus to selected antiviral compounds	2004	J Clin Virol.	10 clinical isolates of SARS coronavirus plaque reduction assays.	glycyrrhizin	**EC50 (µg/ml) at 48 h-** Interferon-beta-1a, leukocytic interferon-alpha, ribavirin, lopinavir, rimantadine, baicalin **EC50 (µg/ml) at 72 h- >400 CC50 (µg/ml)- >400**
Gerold Hoever, Lidia Baltina, Martin Michaelis, Rimma Kondratenko, Lia Baltina, Genrich A. Tolstikov, Hans W. Doerr, and Jindrich Cinatl, Jr	Antiviral Activity of Glycyrrhizic Acid Derivatives against SARS-Coronavirus	2004	J. Med. Chem	Vero cells	Glycyrrhizic Acid Derivatives-glycyrrhizin	inhibiting 50% of virus growth (EC50) of 365 µM against SARS-CoV
				in vitro		GL(glycyrrhizin) was one of the first compounds found to be active against SARScoronavirus (SARS-CoV)
Wu CY, Jan JT, Ma SH, et al.	Small molecules targeting severe acute respiratory syndrome human coronavirus.	2004	*Proc Natl Acad Sci U S A.*	cell-based assay	derivatives of Glycyrrhizin	activities toward SARS-CoV at <100 µM
an de Sand, L., Bormann, M.; Alt, M.;	Glycyrrhizin Effectively Inhibits SARS-	2021	*Viruses*	in vitro, veroE6 cells	glycyrrhizin	1. Antiviral Activity of Licorice Root Extract 2.

Schipper, L.; Heilingloh, C.S.; Steinmann, E.; Todt, D.; Dittmer, U.; Elsner, C.; Witzke, O.; Krawczyk, A	CoV-2 Replication by Inhibiting the Viral Main Protease					inhibition of SARS-CoV-2 Mpro(Main Protease), 3 Effective inhibition of SARS cov-2 replication
M.B. Joshi, A. Kamath, A.S. Nair et al.,	Modulation of neutrophil (dys)function by Ayurvedic herbs and its potential influence on SARS-CoV-2 infection,	2021	*J Ayurveda Integr Med*.	*In vitro:* 25–100 µg/mL in RAW 264.7 macrophages stimulated with LPS	*Glycyrrhiza glabra*	immunomodulatory properties- Inhibits LPS-induced TNF-α, IL-1β, IL-6 production
				In vitro: 50–200 µg/ml in LPS-stimulated mouse endometrial epithelial cells		Glycyrrhizin inhibits LPS-induced TNF-α, IL-1β, NO & PGE2 production
				In vitro: 200, 40, 8 mg/L in LPS-induced macrophage cell line of RAW264.7		lycyrrhizin acid supresses IL-1β, IL-3, IL-5, IL-10, IL-12, IL-13 & TNF- α (LPS stimulated)
				In vivo: 50–100 mg/kg p.o. for 11 days in Male BALB/c mice.		*G. Glabra* with 2 more herbs inhibits airway inflammation by inhibiting inflammatory cytokines TNF- α, IL-17A, IL-6, COX-2

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REFERENCES

1. https://covid19.ncdc.gov.ng/globals/
2. https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)
3. Pal M, Berhanu G, Desalegn C, Kandi V. Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2): An Update. Cureus. 2020 Mar 26;12(3):e7423. doi: 10.7759/cureus.7423. PMID: 32337143; PMCID: PMC7182166.
4. Shanmugaraj B, Siriwattananon K, Wangkanont K, Phoolcharoen W. Perspectives on monoclonal antibody therapy as potential therapeutic intervention for Coronavirus disease-19 (COVID-19). *Asian Pac J Allergy Immunol*. 2020;38(1):10-18. doi:10.12932/AP-200220-0773
5. Gerold Hoever, Lidia Baltina, Martin Michaelis, Rimma Kondratenko, Lia Baltina, Genrich A. Tolstikov, Hans W. Doerr, and Jindrich Cinatl, Jr, Antiviral Activity of Glycyrrhizic Acid Derivatives against SARS-Coronavirus,

Journal of Medicinal Chemistry, 2005, Vol. 48, No. 4, 1256-1259, doi:10.1021/jm0493008.

6. J Cinatl, B Morgenstern, G Bauer, P Chandra, H Rabenau, H W Doerr, Glycyrrhizin, an active component of liquorice roots, and replication of SARS-associated coronavirus, THE LANCET Vol361June14,2003www.thelancet.com
7. F. Chen a, K.H. Chan b, Y. Jiang c, R.Y.T. Kao b, H.T. Lu a, K.W. Fan a, V.C.C. Cheng b, W.H.W. Tsui b, I.F.N. Hung b, T.S.W. Lee b, Y. Guan b, J.S.M. Peiris b, K.Y. Yuen, In vitro susceptibility of 10 clinical isolates of SARS coronavirus to selected antiviral compounds, Journal of Clinical Virology 31 (2004) 69–75, doi:10.1016/j.jcv.2004.03.003
8. Gerold Hoever, Lidia Baltina, Martin Michaelis, Rimma Kondratenko, Lia Baltina, Genrich A. Tolstikov, Hans W. Doerr, and Jindrich Cinatl, Jr, Antiviral Activity of Glycyrrhizic Acid Derivatives against SARS-Coronavirus, Journal of Medicinal Chemistry, 2005, Vol. 48, No. 4, 1256-1259,
9. Chung-Yi Wu, Jia-Tsrong Jan, Shiou-Hwa Ma, Chih-Jung Kuo, Hsueh-Fen Juan§, Yih-Shyun E. Cheng, Hsien-Hua Hsu, Hsuan-Cheng Huang, Douglass Wu, Ashraf Brik, Fu-Sen Liang, Rai-Shung Liu , Jim-Min Fang, Shui-Tein Chen, Po-Huang Liang, and Chi-Huey Wong, Small molecules targeting severe acute respiratory syndrome human coronavirus, PNAS, July 6, 2004, vol. 101 , no. 27, 10012–10017, www.pnas.orgcgidoi10.1073pnas.0403596101
10. van de Sand L, Bormann M, Alt M, Schipper L, Heilingloh CS, Steinmann E, Todt D, Dittmer U, Elsner C, Witzke O, Krawczyk A. Glycyrrhizin Effectively Inhibits SARS-CoV-2 Replication by Inhibiting the Viral Main Protease. *Viruses*. 2021; 13(4):609. https://doi.org/10.3390/v13040609 ,
11. Pruthvi Gowda, Shruti Patrick, Shanker Datt Joshi, Rajesh Kumar Kumawat, Ellora Sen, Glycyrrhizin prevents SARS-CoV-2 S1 and Orf3a induced high mobility group box 1 (HMGB1) release and inhibits viral replication, Cytokine, e 142 (2021) 155496, Elsevier Ltd.
12. M.B. Joshi, A. Kamath, A.S. Nair et al., Modulation of neutrophil (dys)function by Ayurvedic herbs and its potential influence on SARS-CoV-2 infection, J Ayurveda Integr Med, https://doi.org/10.1016/j.jaim.2021.03.006

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