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Supplemental Materials for

The Role of Minerals in COVID-19: An Umbrella Review

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Listing of Supplemental Material(s):

- **Table S1:** Overlap Analysis For Included Systematic Reviews

Table S1: Overlap Analysis For Included Systematic Reviews

		Hunter et al 2021	Fakhrolmobasheri et al 2022	Balboni et al 2022	Olczak-Pruc et al 2022	Feng Z, Yang J, Xu M, et al., 2021	James PT, Ali Z, Armitage AE, et al., 2021	Wang M X, et al. 2021	Vlieg-Boerstra B, et al. 2021	Pechlivanidou E, et al. 2022	Jayawardena R, et al. 2020	Abioye AI, et al. 2021	Beran A, et al. 2022	
Count	**Listing of references**	**502**	**556**	**624**	**756**	**609**	**511**	**522**	**532**	**542**	**608**	**625**	**706**	**TOTAL ROWS**
1	Abdelmaksoud AA, Ghweil AA, Hassan MH, Rashad A, Khodeary A, Aref ZF, et al. Olfactory Disturbances as Presenting Manifestation Among Egyptian Patients with COVID-19: Possible Role of Zinc. Biol Trace Elem Res. 2021;07:07.					x								**1**
2	Abd-Elsalam S, Soliman S, Esmail ES, Khalaf M, Mostafa ef, Medhat MA, Ahmed OA, El Gafar MSA, Alboraie M, Hassany SM. Do zinc supplements enhance the clinical efficacy of hydroxychloroquinine? A randomised, multi-center trial, Biol Trace Elem Res. 199 (10) (2021) 3642-3646			x	x									**2**
3	Abd-Elsalam S, Soliman S, Esmail ES, Khalaf M, Mostafa EF, Medhat MA, et al. Do zinc supplements enhance the clinical efficacy of hydroxychloroquine?: a randomized, multicenter trial. Biol Trace Elem Res 2020:1e5.												x	**1**
4	Acevedo-Murillo JA, et al. Zinc supplementation promotes a Th1 response and improves clinical symptoms in fewer hours in children with pneumonia younger than 5 Years old. A randomized controlled clinical trial. Frontiers in Pediatrics 2019;7(431).										x			**1**

5	Al Sulaiman K, Aljuhani O, Al Shaya AI, Kharbosh A, Kensara R, Al Guwairy A, et al. Evaluation of zinc sulfate as an adjunctive therapy in COVID-19 critically ill patients: a two center propensity-score matched study. Crit Care 2021;25: 363.												x	**1**
6	Alamdari, N.M., Afaghi, S., Rahimi, F.S., Tarki, F.E., Tavana, S., Zali, A., Fathi, M., Besharat, S., Bagheri, L., Pourmotahari, F., Irvani, S., Dabbagh, A., Mousavi, S.A., 2020. Mortality risk factors among hospitalized COVID-19 patients in a major referral center in Iran.									x				**2**
7	Allard L, Ouedraogo E, Molleville J, Bihan H, Giroux-Leprieur B, Sutton A, Baudry C, Josse C, Didier M, Deutsch D, et al. Malnutrition: Percentage and Association with Prognosis in Patients Hospitalized for Coronavirus Disease 2019. Nutrients. 2020; 12(12):3679. https://doi.org/10.3390/nu12123679									x				**1**
8	Allsup SJ, Shenkin A, Gosney MA, Taylor S, Taylor W, Hammond M, Zambon MC. Can a short period of micronutrient supplementation in older institutionalized people improve response to influenza vaccine? A randomized, controlled trial. J Am Geriatr Soc 2004;52:20–4.						x							**1**
9	Al- Nakib W, Higgins PG, Barrow I, et al. Prophylaxis and treatment of rhinovirus colds with zinc gluconate lozenges. J Antimicrob Chemother 1987;20:893–901											x		**1**
10	Arentz S, Hunter J, Yang G, Goldenberg J et al Zinc for the prevention and treatment of SARS CoV-2 and other acute viral respiratory conditions: a rapid review. Adv Integr Med 2020:7:252-60	x												**1**
11	Baqui AH, et al. 2003, Malan L et al. 2015., Richard SA et al. 2006, Friel JK et al. 2001. Mitra AK et al 1997. (Iron)								x					**1**
12	Bellmann-Weiler R, Lanser L, Barket R, Rangger L, Schapfl A, Schaber M, Fritsche G, Wöll E, Weiss G. Prevalence and predictive value of anemia and dysregulated iron homeostasis in patients with COVID- 19 infection. JCM 2020;9:2429.						x	x						**2**

13	Bennouar, S., Cherif, A.B., Kessira, A., Bennouar, D.E., Abdi, S., 2021. Vitamin D deficiency and low serum Ca as predictors of poor prognosis in patients with severe COVID-19. J. Am. Coll. Nutr. 40 (2), 104–110. https://doi.org/10.1080/07315724.2020.1856013.													**1**
14	Bermano G, Meplan C, Mercer DK, Hesketh JE (2021) Selenium and viral infection: are there lessons for COVID-19? Br J Nutr 125:618-27		x											**1**
15	Bhandari N, Bahl R, Taneja S, et al. Effect of routine zinc supplementation on pneumonia in children aged 6 months to 3 years: randomised controlled trial in an urban slum. BMJ. 2002;324(7350):1358- 1361.								x					**1**
16	Broome CS, et al. An increase in selenium intake improves immune function and poliovirus handling in adults with marginal selenium status. Am J Clin Nutr 2004;80(1):154e62.										x			**1**
17	Carlucci PM, Ahuja T, Petrilli C et al. Zinc sulphate in combination with a zinc ionophore may improve outcomes in hospitalised COVID-19 patients. J Med Microbiol 2020;69:1228-34	x		x	x		x							**4**
18	Chaigne-Delalande B, et al. Mg2þ regulates cytotoxic functions of NK and CD8 T cells in chronic EBV infection through NKG2D. Science (New York, N.Y.) 2013;341(6142):186e91.										x			**1**
19	Derwand R, Scholz M, Zelenko V. COVI-19 outpatients: early risk - stratified treatment with zinc plus low dose hydroxychloroquinine and azithromycin: a retrospective case series study. Int J Antimicrob Agents 2020;56:106214	x		x										**2**
20	Duncan A, Yacoubian C, Watson N et al The risk of copper deficiency in patients prescribed zinc supplements. J Clin Pathol 2015;68:723-5	x			x									**2**
21	Eby GA, Davis DR, Halcomb WW. Reduction in duration of common colds by zinc gluconate lozenges in a double-blind study. Antimicrob Agents Chemother 1984;25:20-4	x										x		**2**
22	Farr BM, Conner EM, Betts RF, et al. Two randomized controlled trials of zinc gluconate lozenge therapy of experimentally induced rhinovirus colds. Antimicrob Agents Chemother 1987;31:1183–7.											x		**1**

23	Frise MC, Cheng H-Y, Nickol AH, Curtis MK, Pollard KA, Roberts DJ, Ratcliffe PJ, Dorrington KL, Robbins PA. Clinical iron deficiency disturbs normal human responses to hypoxia. J Clin Invest 2016;126:2139–50.						x							**1**
24	Frontera JA Rahimian JO, Yaghi S et al. Treatment with Zinc is Associated with reduced in hospital mortality among COVID-19 Patients: A multi-centre Cohort Study. Res. Sq 2020; rs.2rs-94509				x									**1**
25	Girodon F, Galan P, Monget A-L, Boutron-Ruault M-C, Brunet-Lecomte P, Preziosi P, Arnaud J, Manuguerra J-C, Hercberg S. Impact of trace elements and vitamin supplementation on immunity and infections in institutionalized elderly patients. Arch Intern Med 1999;159:748.					x	x		x		x			**4**
26	Godfrey JC, Conant Sloane B, Smith DS et al. Zinc gluconate and the common cold: a controlled clinical study. J Int Med Res 1992;20:234-46	x												**1**
27	Goldson AJ, et al. Effects of selenium supplementation on selenoprotein gene expression and response to influenza vaccine challenge: a randomised controlled trial. PloS One 2011;6(3). e14771-e14771.										x			**1**
28	Gordon AM, Hardigan PC. A case controlled study for the effectiveness of oral zinc in the prevention and mitigation of COVID-19. Front Med (Lausanne) 2021;8;756707				x									**1**
29	Guillin OM, Vindry C, Ohlmann T, Chavatte L (2019) Selenium, selenoproteins and viral infection. Nutrients 11:2101		x											**1**
30	Hawkes WC, Hwang A, Alkan Z. The effect of selenium supplementation on DTH skin responses in healthy North American men. J Trace Elem Med Biol : organ of the Society for Minerals and Trace Elements (GMS) 2009;23(4): 272e80. [43]										x			**1**
31	Heller, R.A., Sun, Q., Hackler, J., Seelig, J., Seibert, L., Cherkezov, A., Minich, W.B., Seemann, P., Diegmann, J., Pilz, M., Bachmann, M., Ranjbar, A., Moghaddam, A., Schomburg, L., 2021. Prediction of survival odds in COVID-19 by zinc, age and selenoprotein P as composite biomarker. Redox Biol. 38, 101764. https://doi.org/ 10.1016/j.redox.2020.101764.									x				**1**

32	Heller, R.A., Sun, Q., Hackler, J., Seelig, J., Seibert, L., Cherkezov, A., Minich, W.B., Seemann, P., Diegmann, J., Pilz, M., Bachmann, M., Ranjbar, A., Moghaddam, A., Schomburg, L., 2021. Prediction of survival odds in COVID-19 by zinc, age and selenoprotein P as composite biomarker. Redox Biol. 38, 101764. https://doi.org/10.1016/j.redox.2020.101764.													**1**
33	Hiffler L, Rakotoambinina B (2020) Selenium and RNA virus interactions: potential implications for SARS Cov-2 infection (COVID-19). Front Nutr 7:164		x											**1**
34	Hojyo S, Fukada T. Roles of zinc signaling in the immune system. J Immunol Res. 2016;2016:6762343				x									**1**
35	Ibs KH, Rink L. Zinc altered immune function. J Nutr. 2003;133 (5Suppl 1):1452S-6S				x									**1**
36	Iovino L, et al. High-dose zinc oral supplementation after stem cell trans- plantation causes an increase of TRECs and CD4þ naive lymphocytes and prevents TTV reactivation. Leuk Res 2018;70:20e4.										x			**1**
37	Ivory K, Prieto E, Spinks C, Armah CN, Goldson AJ, Dainty JR, Nicoletti C. Selenium supplementation has beneficial and detrimental effects on immunity to influenza vaccine in older adults. Clin Nutr 2017;36:407–15.						x				x			**2**
38	Jothimani D, Kailasam E, Danielraj S et al COVID-19: Poor outcomes in patients with zinc deficiency. Int J Infect Dis. 2020;100:343-349				x			x		x				**3**
39	Kashefizadeh, A., Ohadi, L., Golmohammadi, M., Araghi, F., Dadkhahfar, S., Kiani, A., Abedini, A., Fadaii, A., Ghojoghi, A., Nouraie, M., Tabary, M., 2020. Clinical features and short-term outcomes of COVID-19 in Tehran, Iran: an analysis of mortality and hospital stay. Acta Biomed. : Atenei Parmensis 91 (4), e2020147. https://doi.org/10.23750/abm.v91i4.10206.									x				**2**
40	Kieliszek M (2019) Selenium-fascinating microelement, properties, sources in food.Molecules 24:1298		x											**1**

41	Lagier, J.C., Million, M., Gautret, P., Colson, P., Cortaredona, S., Giraud-Gatineau, A., Honor´e, S., Gaubert, J.Y., Fournier, P.E., Tissot-Dupont, H., Chabri`ere, E., Stein, A., Deharo, J.C., Fenollar, F., Rolain, J.M., Obadia, Y., Jacquier, A., La Scola, B., Brouqui, P., Drancourt, M., Parola, P., Raoult, D., IHU COVID-19 Task force, 2020. Outcomes of 3,737 COVID-19 patients treated withhydroxychloroquine/azithromycin and other regimens in Marseille, France: a retrospective analysis. Trav.Med. Infect. Dis. 36 https://doi.org/10.1016/j.tmaid.2020.101791, 101791.									x				**2**
42	Liu, J., Han, P., Wu, J., Gong, J., Tian, D., 2020. Prevalence and predictive value of hypocalcemia in severe COVID-19 patients. J Infect Public Health 13 (9), 1224–1228. https://doi.org/10.1016/j.jiph.2020.05.029.													**1**
43	Maywald M, Wessels I, Rink L. Zinc signals and immunity, Int J. Mol. Sci. 18 (10) (2017) 2222			x										**1**
44	Moghaddam A, Heller RA, Sun Q et al (2020) Selenium deficiency is associated with mortality risk from COVID-19. Nutrients 12:2098		x	x						x				**4**
45	Mossad SB, Macknin ML, Medendopr SV et al Zinc gluconate lozenges for treating the common cold. A randomised, double-blind, placebo controlled study. Ann Intern Med 1996;125:81-8	x												**1**
46	Overbeck S, Rink L, Haase H. Modulating the immune response by oral zinc supplementation: a single approach for multiple diseases. Arch Immunol Ther Exp (Warsz) 2008;56:15–30.						x							**1**
47	Page MJ, McKenzie JE, Bossuyt PM et al. The PRISMA 2020 statement; an updated guideline for reporting systematic reviews. BMJ 2021:372:n71	x	x		x									**3**
48	Patel O, Chinni V, El-Khoury J, Perera M, Neto AS, McDonald C, See E, Jones D, Boutlon D, Bellomo R, Trubiano J, Ischia J. A pilot double-blind safety and feasibility randomised controlled trial of high-dose intravenous zinc in hospitalised COVID-19 patients. J Med Virol 93 (5) 20213261-3267			x	x								x	**3**
49	Pizzini, A. et al. Nutrients 2020, 12(9), 2775; https://doi.org/10.3390/nu12092775 (Calcium)							x						**1**

50	Prasad AS Beck FWJ Bao B et al. Duration and severity of symptoms and levels of plasma interleukin-1 receptor antagonist, soluble tumour necrosis factor receptor and adhesion molecules in patients with the common cold treated with zinc acetate.J Infect Dis 2008;197:795-802	x												**1**
51	Prasad AS, Beck FWJ, Bao B et al.Zinc supplementation decreases incidence of infections in the elderly: effect of zinc on generation of cytokines and oxidative stress. Am J Clin Nutr 2007;85:837-44	x												**1**
52	Prasad AS, Fitzgerald JT, Bao B et al Duration of symptoms and plasma cytokine levels in patients with the common cold treated with zinc acetate. A randomised, double-blind, placebo-controlled trial. Ann Intern Med 2000;133:245-16	x												**1**
53	Provinciali M, et al. Effect of zinc or zinc plus arginine supplementation on antibody titre and lymphocyte subsets after influenza vaccination in elderly subjects: a randomized controlled trial. Age Ageing 1998;27(6):715e22.										x			**1**
54	Savy M, Edmond K, Fine PEM, Hall A, Hennig BJ, Moore SE, Mulholland K, Schaible U, Prentice AM. Landscape analysis of interactions between nutrition and vaccine responses in children. J Nutr 2009;139:2154S–218S.						x							**1**
55	Shakoor H, Feehan J, Dhaheri ASA et al (2021) Immune boosting role of vitamins D, C, E, zinc, selenium and omega 3 fatty acids: could they help against COVID-19? Maturitas 143:1-9		x	x										**2**
56	Sonnweber T, Pizzini A, Tancevski I, Löffler-Ragg J,Weiss G. Anaemia, iron homeostasis and pulmonary hypertension: a review. Intern Emerg Med 2020;15:573–85.						x							**1**
57	Sterne JAC, Savovic J, Page MJ, Elbers NS, Blencowe I, Boutron C, Cates J, Cheng HY,Corbett MS, Eldrige JR,Emberson MA, Hernan MA, Hopewell S, Hrobjartson A, Junquiera DR, Juni P, Kirkham JJ, Lasserson T, Li A, McAleenan BC, Reeves S, Shepperd I, Shriver LA, Stewart K, Tilling I, White PF, Whiting JPT, Higgins. RoB2 a revised tool for assessing risk of bias in randomised trials, BMJ 366 (2019) 14898			x	x									**2**

58	Szarpak L, M.Pruc, A Gasecka, MJ Jagusewzki, T.Michalski, FW Peacock, J.Smereka, K. Pytkowska, KJ Filipak. Should we supplement zinc in COVID-19 patients? Evidence from a meta-analysis, Pol.Arch. Intern Med 131(9) (2021) 802-807			x	x									**2**
59	te Velthuis AJW, van den Worm SHE, Sims AC et al zN2+ inhibits coronavirus and arterivirus RNA polymerase activity in vitro and zinc ionophores block the replcation of these viruses in cell culture. Plos Pathog 2020;6:e1001176	x		x	x									**3**
60	Thomas S, Patel D, Bittel B, Wolski K, Wang Q, Kumar A, Il'Giovine Z, Mehra R, McWilliams C, Nissen SE, Desai MY. Effect of high dose zinc and absorbic acid supplementation vs usual care on symptom length and reduction among ambulatory patients with SARS-CoV-2 infection: the COVID A-Z randomised clinical trial JAMA Netw. Open 4 (2) (2021)			x	x	x							x	**4**
61	Turner RB. Ineffectiveness of intranasal zinc gluconate for prevention of experimental rhinovirus colds. Clin Infect Dis 2001;33:1865–70.											x		**1**
62	Veverka DV, Wilson C, Martinez MA, et al. Use of zinc supplements to reduce upper respiratory infections in United States air force Academy cadets. Complement Ther Clin Pract 2009;15:91–5.											x		**1**
63	Weismann K, Jakobsen JP, Weismann JE, et al. Zinc gluconate lozenges for common cold. A double- blind clinical trial. Dan Med Bull 1990;37:279–81.											x	x	**2**
64	Wu, C., Chen, X., Cai, Y., Xia, J., Zhou, X., Xu, S., Huang, H., Zhang, L., et al. Risk Factors Associated Distress Syndrome and Death in Patients with Coronavirus Diesase 2019 Pneumonia in Wuhan, China. *JAMA Intern. Med*. 2020, 180, 934-943. DOI: 10.1001/jamainternmed.2020.0994 (Iron)							x						**1**
65	Wu, Y., Hou, B., Liu, J., Chen, Y., Zhong, P., 2020. Risk factors associated with long-term hospitalization in patients with COVID-19: a single-centered, retrospective study. Front. Med. 7, 315. https://doi.org/10.3389/fmed.2020.00315.													**1**
66	Xue J, Moyer A, Peng B et al. Chloroquine is a zinc ionophore. PLoS oNE. 2014:9(10)e109180				x									**1**

67	Yang, C., Ma, X., Wu, J., Han, J., Zheng, Z., Duan, H., Liu, Q., Wu, C., Dong, Y., Dong, L., 2021. Low serum calcium and phosphorus and their clinical performance in detecting COVID-19 patients. J. Med. Virol. 93 (3), 1639–1651. https://doi.org/10.1002/jmv.26515.													**1**
68	Yao JS, Paguio JA, Dee EC et al. The minimal effect of zinc on the survival of hospitalised patients with COVID-19: an observational study. Chest 2021;159;108-11	x		x	x								x	**4**
69	Yasui Y, Yasui H, Suzuki K, et al. Analysis of the predictive factors for a critical illness of COVID-19 during treatment — relationship between serum zinc level and critical illness of COVID-19. Int J Infect Dis. 2020;100:230-236. doi:10.1016/j.ijid.2020.09.008							x						**1**
70	Zhang J, Taylor EW, Bennet K et al (2020) Association between regional selenium status and reported outcome of COVID-19 cases in China. Am J Clin Nutr 111:1297-1299		x											**1**
71	Zhao, C., Bai, Y., Wang, C., Zhong, Y., Lu, N., Tian, L., Cai, F., Jin, R., 2021. Risk factors related to the severity of COVID-19 in Wuhan. Int. J. Med. Sci. 18 (1), 120–127. https://doi.org/10.7150/ijms.47193.													**1**
72	Zheng, R., Zhou, J., Song, B., Zheng, X., Zhong, M., Jiang, L., Pan, C., Zhang, W., Xia, J., Chen, N., Wu, W., Zhang, D., Xi, Y., Lin, Z., Pan, Y., Liu, X., Li, S., Xu, Y., Li, Y., Tan, H., Zhong, N., Luo, X., Sang, L., 2021. COVID-19-associated coagulopathy: thromboembolism prophylaxis and poor prognosis in ICU. Exp. Hematol. Oncol. 10 (1), 6. https://doi.org/10.1186/s40164-021-00202-9.													**1**
	TOTAL	**13**	**8**	**12**	**16**	**2**	**9**	**5**	**3**	**7**	**8**	**5**	**6**	**108**