Traditional soap plants used in hand hygiene, can play an important role in curbing infectious diseases including COVID-19. So why is there so little research?

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Abstract

The standard recommendations for reducing the risk of transmission of COVID-19 include the use of hand sanitisers, and regular handwashing. However, worldwide few have access to soap and water, let alone hand sanitiser. Kunwinjku relatives in western Arnhem Land, NT, Australia believed they had no protection except prayer.

Yet soap plants are found on every inhabited continent, including Australia and were used widely by Aboriginal peoples. Soap plants contain saponins, phytochemicals that display a range of pharmacological properties.

Given the plethora of research on the anti-viral, anti-bacterial and anti-fungal properties of plant-based saponins, and the number of people at risk from COVID-19 there should be much literature on their topical use. However, in 2020 I found none and even now little exists. Research institutions must begin “think outside the box”, to see the world through the eyes of others and act accordingly.

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Introduction

COVID-19 was declared a pandemic by the World Health Organisation on 11 March, 2020 (Cucinotta, D.; Vanelli, 2020), and within six weeks reports of its spread had reached Aboriginal relatives living in Arnhem Land, NT, Australia. Distrustful of western medical practitioners they believed that God and prayer was all that stood between them and serious illness or death. One example of the strength of their faith was displayed in 2019 when a child was electrocuted. The women prayed over the boy, their messages on Facebook later indicating their belief that their prayers saved him (12 January, 2020). In relation to news about the pandemic they began to post messages on Facebook for all to pray.

The standard recommendations for reducing the risk of transmission include social distancing, the wearing of masks, the use of hand sanitisers, and regular handwashing. However, worldwide few have access to soap and water (Kunatsa & Katerere, 2021), let alone hand sanitiser, and except for water my relatives were no exception; many couldn't afford to buy hand sanitiser. Moreover, when soap was available the number of people using it soon reduced the bar to little more than a sliver, making it largely ineffective. When staying with relatives I took sorbolene (being allergic to soap). At funerals I attended several hundred people could be present and on such occasions good hand hygiene was virtually impossible.

That most hand sanitiser is alcohol-based was also a concern, and one that had not been pointed out to my relatives by the authorities promoting its use. These products may contain up to 80% ethanol (Lopez-Gigosos et al., 2023). Ingestion of hand sanitiser as a source of alcohol also became a "serious issue" in Alice Springs, NT where sales of alcohol are tightly controlled, and resulted in an increase in hospitalisations (Haskin, 2021). As well there was an increase in alcohol poisonings of both children and adults (NSW Health, 2020). Alcohol-based hand sanitiser can also cause irritation and allergies (Lopez-Gigosos et al., 2023).

Yet my relatives, like Aboriginal people living in other remote areas, had access to soap plants.

Saponins

Soap plants contain saponins, a soap-like substance (Kregiel et al., 2016) (the term 'saponin' comes from the Latin 'sapo' for soap). Soap contains molecules called amphiphiles that dissolve the fat membrane of viruses rendering them inactive (Lorent, et al., 2014; Thordarson, 2020), as do saponins. Saponins form part of the plant's defences against disease and herbivore activity (Mugford & Osbourn, 2012).

Saponins have been found in nearly one hundred plant families (Oleszek & Oleszek, 2019; Vincken et al., 2007) and in both monocots such as the Dioscoreaceae, Melanthiaceae and Asparagaceae (Li, et al., 2023), and in dicots, for example, Bombaceae, Capparaceae, Fabaceae and Rhamnaceae (Aboriginal Communities of the NT, 1993). Kunatsa &

Katerere (2021, p. 4-7) in their comprehensive study of African plants containing saponins found 68 species belonging to 32 families, most of which were dicots. Soap plants grow on every inhabited continent and are widely used as soaps and detergents.

I had used soap plants since the mid 1980s while carrying out surveys of flora and fauna in the Top End bush. Often working in temperatures of 35°C or more and in humidity greater than 70% I sometimes developed skin rashes, and soap plants were the most effective and available treatment, particularly when water was in short supply. I simply crushed leaves (or green seed pods) and added a little water. The species I mostly used (because they were so common) were *Acacia holosericea* and *A. auriculiformis* (Fabaceae).

The first lockdowns of the pandemic in 2020 resulted in a rush on cleaning products and shelves in the nearest supermarket 65 kms away were often empty. Consequently, I reverted to using the soap plants which grew on our property, namely the two species I had often used out bush, and also *Alphitonia excelsa* (Rhamnaceae), which grows near the house. I ground the leaves and used them as hand and body wash, hair shampoo and in washing clothes. The only issue? Green stains on white sheets and clothing!

Soap plants contain saponins, phytochemicals that display a range of pharmacological properties. For example, they have found to be anti-inflammatory, anti-microbial, anti-fungal and anti-viral; a 2021 study in silico (Rehan & Shafiullah) found that thirteen saponins exhibited high potency against the coronavirus. Saponins can decrease blood lipids and help protect against cancers (Desai et al. 2009; Elekofehinti, 2021; Kim et al., 2022; Mieres-Castro & Mora-Poblete 2023) and disorders of the central nervous system such as stroke, Alzheimer's disease, Parkinson's disease, and Huntington's disease (Sun et al., 2015). They have been shown to have analgesic effects, for example, in the treatment of neuropathic pain (Tan, et al., 2022). Potentially, saponins may relieve disease-related symptoms and clinical complications and improve the efficacy and safety of vaccines (Mieres-Castro & Mora-Poblete, 2023; Sharma, 2020).

The UN states that about three billion people do not have access to soap and water in their homes, (let alone hand sanitiser) putting an estimated one billion people at risk of COVID-19 (and other infectious diseases) simply because "they lack basic handwashing facilities" (Kunatasa & Katerere, 2021, p. 2; Unicef, WHO 2020). Kunatasa & Katerere, (2021 p. 2) have suggested that a possible strategy in increasing hand hygiene might be to make available a list of soap plants available to poor and rural communities. Based on the literature such saponins can even be used on sensitive skin (Nizioł-Łukaszewska & T. Bujak, 2018).

The lack of research

Given the plethora of research on plant-based saponins already available in 2020, and the number of people at risk from COVID-19 there should have been much literature on the topical use of plant saponins. However, I found none, nor did Kunatsa and Katerere when they published their paper a year later, in 2021. After a pharmacist friend agreed that saponins would probably kill the virus on skin I urged Aboriginal relatives to use traditional soap plants as handwash.

In May 2023, The Conversation published a piece by Professor David Katerere and his PhD student, Yvonne Kunatsa. Their research came, not from the sites of learning or corporations of the western world, but from a university in a so-called developing country (Tshawne University, Acadia, South Africa). The title of the paper says it all: 'Checklist of African Soapy Saponin – Rich Plants for Possible Use in Communities' Response to Global Pandemics'. I began to spread the word. However, the only ray of interest came from a close relative who is a team leader in Aboriginal Health in southern Australia. He and his nursing staff were interested in planting a soap plant garden. However, I am still looking for a list of soap plants for that state.

Conclusion

Kunatsa and Katerere (2020, p. 2) suggest that there is an assumption that soap is available to every person throughout the world. In the case of Australian authorities, I suspect that assumption has also been made about hand sanitisers, or that they are suitable for all individuals, every community.

IThe move to enshrine an Aboriginal voice in the Australian constitution, will give people like my relatives the basic right "to participate in political decisions that affect their economic and social conditions" (Rice, 2023, p. 15). Speaking out on something as important as hand hygiene in the time of COVID-19, must be one of those basic rights.

I believe it's past time that research institutions began to "think outside the box", to see the world through the eyes of others and act accordingly; show they can meet Aboriginal people half-way. Indeed, that may help us all.

References

- Aboriginal Communities of the NT (1993) *Traditional Aboriginal Medicines in the Northern Territory of Australia.* Conservation Commission of the Northern Territory, Australia.
- Cucinotta, D. & Vanelli, M. (2020). WHO Declares COVID-19 a Pandemic. *Acta Bio Med. Atenei Parm. 91*, 157–160.
- Desai, S.D.; Desai, D.G.; Kaur, H. (2009). Saponins and Their Biological Activities. *Pharma Times, 41*, 13–16. Accessed 4 June, 2023. https://www.researchgate.net/publication/288126191_Saponins_and_their_biological_activities/citations.
- Elekofehinti, O.O., Iwaloye, O., Olawale, F., & Ariyo, E.O. (2021). Saponins in Cancer Treatment: Current Progress and Future Prospects. *Pathophysiology, 28*(2):250-272. doi: 10.3390/pathophysiology28020017. PMID: 35366261; PMCID: PMC8830467. Accessed 4 June, 2023.
- Goodfellow, D.L. (2020). Hand-washing in the bush: Traditional 'soap' plants provide alternatives to hand sanitisers. 23 May. https://www.impress.com.au/newsroom/denise-goodfellow/2262-hand-washing-in-the-bush.html.
- Haskin, E. (2021). Fears grow for people drinking hand sanitiser in Alice Springs. 13 Aug. https://www.abc.net.au/news/2021-08-13/fears-hand-sanitiser-drinkers-in-central-australia/100313704. Accessed 9 April, 2023.
- Kim, T.Y., Kim, J.Y., Kwon, H.C., Jeon, S., Lee, S.J., Jung. H., Kim, S., Jang, D.S., & Lee, C.J. (2022). Astersaponin I

from *Aster koraiensis* is a natural viral fusion blocker that inhibits the infection of SARS-CoV-2 variants and syncytium formation. *Antiviral Res., 208*:105428. doi: 10.1016/j.antiviral.2022.105428. Epub 2022 Oct 15. PMID: 36252824; PMCID: PMC9568284.

- Kregiel, D., Berlowska, J., Witonska, I., Antolak, H., Proestos, C., Babic, M., Babic, L. & Zhang, B. (2017). Saponin-Based, Biological-Active Surfactants from Plants, Application and Characterization of Surfactants, Reza Najjar*, IntechOpen,* doi: 10.5772/68062. https://www.intechopen.com/books/application-and-characterization-of-surfactants/saponin-based-biological-active-surfactants-from-plants.
- Kunatsa, Y. & Katerere, D.R. (2021). Checklist of African Soapy Saponin – Rich Plants for Possible Use in Communities' Response to Global Pandemics. *Plants*, *10*, 842. https://doi.org/10.3390/ plants10050842. Accessed 14 April, 2023.
- Li, Y.; Yang, H.; Li, Z.; Li, S.; Li, J. (2023). Advances in the Biosynthesis and Molecular Evolution of Steroidal Saponins in Plants. *Int. J. Mol. Sci*., *24*,2620. https://doi.org/ 10.3390/ijms24032620. Accessed 4 June, 2023.
- Lopez-Gigosos, R.M., Mariscal-Lopez, E., Gutierrez-Bedmar, M., & Mariscal, A. (2023). Effect of Long-Term Use of Alcohol-Containing Handwashing Gels on the Biofilm-Forming Capacity of *Staphylococcus epidermidis*, *Int J Environ Res Public Health*. Mar 13;20(6):5037. Doi: 10.3390/ijerph20065037. PMID: 36981945. Accessed 5 June, 2023.
- *Lorent J.H., Quetin-Leclercq J. & Mingeot-Leclercq M.P. (2014). The amphiphilic nature of saponins and their effects on artificial and biological membranes and potential consequences for red blood and cancer cells. Org Biomol Chem, 12(44):8803-8822. doi:10.1039/c4ob01652a*
- Mieres-Castro, D. & Mora-Poblete, F. (2023). Saponins: Research Progress and Their Potential Role in the Post-COVID-19 Pandemic Era. *Pharmaceutics*. Jan 20;15(2):348. Doi: 10.3390/pharmaceutics15020348. PMID: 36839670; PMCID: PMC9964560. Accessed 4 June, 2023.
- Mugford, S.T. & Osbourn, A. (2012). S*aponin Synthesis and Function. Isoprenoid Synthesis in Plants and Microorganisms.* Aug 22:405–24. Doi: 10.1007/978-1-4614-4063-5_28. PMCID: PMC7121976. Accessed 4 June, 2023.
- ncov2019.live. World COVID-19 Stats. 2023. https://ncov2019.live/data. Accessed on 5 June, 2023.
- Nizioł-Łukaszewska, Z. & Bujak, T. (2018) Saponins as natural raw materials for increasing the safety of bodywash cosmetic use, *Journal of Surfactants and Detergents, 21*(6):767–776, 2018.
- NSW Health, 2020). *Hand sanitiser safety and children,* NSW Government, 12 April. https://www.health.nsw.gov.au/news/Pages/20200412_01.aspx. Accessed 5 June, 2023.
- Oleszek M. & Oleszek W. (2019). Saponins in Food. In: Xiao J., Sarker S.D., Asakawa Y., editors.*Handbook of Dietary Phytochemicals.* 1st ed. Volume 1. Springer; Singapore: 1–40. Accessed 4 June, 2023.
- Pahurkar, S. Narkhede, & Kardile, M. (2022). Formulation and Evaluation of Herbal Handwash Gel from Jasmine Leaf Extract with Antimicrobial Activity. I*nternational Journal of Pharmaceutical Research and Applications, 7*(4): 1163-1169. Doi: 10.35629/7781-070411631169.
- Rehan, M. & Shafiullah, (2021). *Tradit Med Res., 6*(3):24. Doi: 10.12032/TMR20201130210.
- Rice, S. (2023). The Voice is all about human rights, not 'special measures'.*The Weekend Australian,* Feb. 4-5, p. 15.
- Sharma, R., Palanisamy, A., Dhama, K., Mal, G., Singh, B. & Singh, K.P. (2020). Exploring the possible use of saponin adjuvants in COVID-19 vaccine. *Hum Vaccin Immunother.* Dec 1;16(12):2944-2953. Doi:

10.1080/21645515.2020.1833579. Epub 2020 Dec 9. PMID: 33295829; PMCID: PMC7738204. Accessed 4 June, 2023.

- Sparg S.G., Light M.E. & van Staden J. (2004). Biological activities and distribution of plant saponins*J. Ethnopharmacol.* 94:219–243. Doi: 10.1016/j.jep.2004.05.016. Accessed 4 June, 2023.
- Sun, A., Xu, X., Lin, J., Cui, X., & Xu, R. (2015). Neuroprotection by saponins.*Phytother Res.* Feb;29(2):187-200. Doi: 10.1002/ptr.5246. Epub 2014 Nov 19. PMID: 25408503. Accessed 4 June, 2023.
- Tan, B., Wu, X., Yu, J., & Chen, Z. (2022). The Role of Saponins in the Treatment of Neuropathic Pain*Molecules*, *27*(12), 3956. MDPI AG. http://dx.doi.org/10.3390/molecules27123956. Accessed 4 June, 2023.
- *Thordarson, P. (2020). The science of soap – here's how it kills the coronavirus. The Guardian, 12 March.* https://www.theguardian.com/commentisfree/2020/mar/12/science-soap-kills-coronavirus-alcohol-based-disinfectants.
- Unicef, WHO (2020). *Hand hygiene for all.* https://www.unicef.org/reports/hand-hygiene-for-all-2020.
- Vincken J.-P., Heng L., de Groot A., Gruppen H. (2007). Saponins, classification and occurrence in the plant kingdom. *Phytochemistry, 68*:275–297. Doi: 10.1016/j.phytochem.2006.10.008. Accessed 4 June, 2023.
- Yang Y., Laval S., & Yu B. (2014). Chemical Synthesis of Saponins.*Adv. Carbohydr. Chem. Biochem, 71*:137–226. Doi: 10.1016/b978-0-12-800128-8.00002-9. Accessed 4 June, 2023.