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Potential Use of Secoyohimban Derivatives isolated from Water hyacinth as inhibitors of the COVID-19 Virus

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COVID-19 is an abbreviation for Coronavirus disease 2019 referring to an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The disease was first identified in 2019 in Wuhan, Central China, and has since spread globally, resulting in the 2019–20 coronavirus pandemic (With more than 300 thousand infections by early 2020)¹.

During 2005, chloroquine was discovered as potent inhibitor of SARS coronavirus infection, the action of chloroquine is preventing the spread of SARS CoV in cell culture². This effect was due to prophylactic and therapeutic advantages. In addition to the well-known functions of chloroquine, such as elevations of endosomal pH, the drug appears to interfere with terminal glycosylation of the cellular receptor, angiotensin converting enzyme (ACE-2)².

Currently, different countries and agencies talk about the potential use of chloroquine as potent inhibitor of Covid-19 virus (the virus shares substantial similarity with SARS-CoV)³. Some of pharmaceutical companies announced initial positive feedback for the effect of this drug as inhibitor of COVID-19.

This activity may be due to the unique chemical structure of chloroquine which has two benzene rings, with five double bonds and several electronegative atoms (Figure 1). In this journal, we published various articles during 2010 and 2014^{4,5} for the effect of isolated compounds from the Amazonian invasive species water hyacinth (*Eichhornia crassipes* (Mart.) Solms) from River Nile in Egypt inhibiting different bacteria, yeast, fungi and human cancer. They had high activity when compared with antibiotics and other standards (IPR was registered for all compounds in the Academy of Scientific Research, Patent office, Egypt).

Why we expected the potential use of Secoyohimban alkaloids and derivatives as inhibitors for COVID-19?

- a) There is great similarity in the chemical structure between the chloroquine and one compound isolated from water hyacinth (Secoyohimban derivatives) as shown in

Figure (1). Furthermore, The Figure (2) illustrates the resonance phenomena happened in both compounds and gave the similarity picture for the main part of these compounds which emphasize the ability of Secoyohimban as an anti COVID-19.

- b) There is great similarity in the biological activities and active groups between the both compounds as shown in Table 1. This similarity may be given high potential for use the natural compounds from water hyacinth as antiviral activities via its affect in elevations of endosomal pH.
- c) Possibly these natural compounds acts as competitive inhibitors of the virus during its receptor (S protein-human ACE2 interface)³ or interaction directly with S-Protein (in the COVID 19 structure) and this may be due to the suggested interaction between the active groups in the chemical structure of this compound and amino acid chains in the S-protein or in the ACE2 receptor³ as shown in Figures 3.

Figure 1: The chemical structure of Chloroquine and Secoyohimban Derivatives

Table 1: The chemical properties of Chloroquine and Secoyohimban Derivatives

Properties	Compounds name	
	Chloroquine	18, 19-Secoyohimban-19-oic acid, 16, 17, 20, 21-tetradehydro-16-(hydroxymethyl)-, methyl ester (15 beta, 16 E)
The chemical formula	$C_{18}H_{26}Cl N_3$	$C_{21}H_{23}N_2O_3$
M.Wt	320 Da	352 Da
Chemical nature	Alkaloid	Alkaloid
Resonance groups	<p>Benzene ring – double bonds</p> <p>Electron-rich molecules (N, Cl)</p>	<p>Benzene ring – double bonds</p> <p>Electron-rich molecules (N-O)</p>
Biological activities (according to what mentioned in published articles)	<p>- Antimalarial</p> <p>-Anti-inflammatory–antioxidant activities</p>	<p>- Antibiotics active against some pathogenic strains of bacteria, fungi and algae.</p> <p>- Anticancer and antioxidant activities</p>

Figure 2: The Resonance Phenomena in main part of Chloroquine and Secoyohimban Derivatives

Our findings indicate that natural compound isolated from water hyacinth may be used as potent inhibitor of COVID-19 virus and we will start the extraction and separation of this active ingredient with high amount for testing it as anti-COVID-19 in addition to use docking study as a strategy to identify the interaction between the active ingredient and target/ (receptor), in cooperation with the National Research Centre in Egypt.

Figure 3: Suggested Secoyohimban S-protein or ACE2 receptor interaction diagram. Residues with (A) correspond to the S-protein, while those with (B) correspond with the ACE2 receptor³.

Once confirmed the usage of active ingredients from water hyacinth which was grown in Nile River starting from Ethiopia to Egypt via Sudan, this might bring all back to solve water issues because they will switching the dialogue to be discussed about the economic revenues after using the active ingredients from water hyacinth.

In conclusion, COVID-19 might solve the problems between nations due to scientific outcomes for treatments from water hyacinth and positive economic feedbacks.

References

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