



Check for updates

DATA NOTE

The computationally predicted drug-likeness, pharmacokinetics properties, medicinal chemistry parameters, and toxicity properties of *Cucurbita maxima* compounds.

[version 1; peer review: 2 approved]

Ryman Shoko 

Biology, Chinhoyi University of Technology, Chinhoyi, Zimbabwe

V1 First published: 31 Oct 2022, 11(Chem Inf Sci):1234
<https://doi.org/10.12688/f1000research.127126.1>

Latest published: 31 Oct 2022, 11(Chem Inf Sci):1234
<https://doi.org/10.12688/f1000research.127126.1>

Abstract

Natural compounds are increasingly becoming an important source of drug leads for computer-aided drug design approaches. *Cucurbita maxima* has been observed to have medicinal properties and can, therefore, be a potential source of novel drug leads. However, before compounds can be synthesized in the lab for tests, modern approaches require that the candidate compounds be screened for drug-likeness characteristics and toxicity, among others. In this work, the computational tools, SwissADME and DataWarrior were used to screen *C. maxima* compounds for their potential consideration as drug leads. A total of 130 compounds, downloaded from the LOTUS natural products database, were computationally analysed. The data set presented in this work will be useful to researchers searching for novel drug leads based on natural compounds.

Keywords

Cucurbita maxima, medicinal plants, druglikeness, natural products, pharmacoinformatics

Open Peer Review

Approval Status

	1	2
version 1		
31 Oct 2022	view	view

1. **Edgar López-López** , Department of Chemistry and Graduate Program in Pharmacology, Center for Research and Advanced Studies of the National Polytechnic Institute,, Mexico City, Mexico

2. **Gurudutt Dubey**, Indian Institute of Technology (IIT), Palaj, India
Universidad Catolica de Valencia San Vicente Martir (Ringgold ID: 83140), Valencia, Spain

Any reports and responses or comments on the article can be found at the end of the article.



This article is included in the **Cheminformatics** gateway.

Corresponding author: Ryman Shoko (shoko.ryman@gmail.com)

Author roles: Shoko R: Conceptualization, Data Curation, Investigation, Methodology, Writing – Original Draft Preparation

Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

Copyright: © 2022 Shoko R. This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Shoko R. **The computationally predicted drug-likeness, pharmacokinetics properties, medicinal chemistry parameters, and toxicity properties of *Cucurbita maxima* compounds. [version 1; peer review: 2 approved]**
F1000Research 2022, 11(Chem Inf Sci):1234 <https://doi.org/10.12688/f1000research.127126.1>

First published: 31 Oct 2022, 11(Chem Inf Sci):1234 <https://doi.org/10.12688/f1000research.127126.1>

Introduction

Natural products (NP), such as plants and their extracts, have been used to cure diseases in humans and livestock since ancient times (Daina *et al.*, 2017; Greenwell & Rahman, 2015). In modern computer-aided drug design approaches, NPs are considered to be a significant foundation for drug discovery due to their diverse chemical components and their often-unique biomedical properties (Süntar, 2020). Among their unique properties, the NPs are often rich in stereogenic centres and occupy portions of the chemical space that is usually not covered by most synthetic drugs (Marxer *et al.*, 2012).

Cucurbita maxima (commonly known as giant pumpkin) is rich in phenolics, tannins, flavonoids, alkaloids, saponins, terpenoids, carbohydrates and proteins (Salehi *et al.*, 2019; Sorescu *et al.*, 2020). For centuries, extracts from different parts of the plant have been used to treat various diseases such as intestinal infections, renal failure, hyperplasia, constipation, and parasite infestation (Menendez-Baceta *et al.*, 2014; Kujawska & Pieroni, 2015; Mahomoodally *et al.*, 2016; Mtemeli *et al.* 2021). Thus, CADD approaches can be applied to investigate the potential of some compounds from this plant to act as drug leads. Before synthesising a compound in the laboratory for testing, modern computational approaches require that the compounds be computationally screened for drug-likeness and potential toxicity.

The standard method to evaluate drug-likeness of a compound is to assess compliance to Lipinski's Rule of Five (Lipinski *et al.*, 1997), which covers the molecular weight, numbers of hydrophilic groups and hydrophobicity. This data note presents a list of *C. maxima* natural compounds and their computationally calculated data on drug-likeness characteristics, pharmacokinetics, medicinal chemistry parameters and predicted toxicity. Toxicity predictions are important because substructures with known toxic, **teratogenic** or **mutagenic** properties negatively affects the usefulness of a designed drug. With data produced in this work, researchers can better predict which *C. maxima* compounds have a better chance of succeeding throughout all stages of clinical trials, through to drug approval.

Materials and methods

To create a library of *C. maxima* natural compounds, the term 'Cucurbita maxima' was entered into the search box of the Lotus Natural Compounds Database (<https://lotus.naturalproducts.net/>). The search returned 130 natural products. A file containing the 130 compounds in the structure-data file (SDF) format was downloaded and then fed into BIOVIA Discovery Studio v21.1.0.20298, RRID:SCR_015651 to get the molecular structures in the corresponding **simplified molecular-input line-entry system** (SMILE) format. The SMILEs were then used to calculate the various properties of the compounds using the SwissADME (Daina *et al.*, 2017) web tool and the DataWarrior v5.5.0 (Sander *et al.*, 2015) software.

Dataset validation and limitations

An inherent limitation of computational prediction of drug-likeness is the lack of validated datasets of drugs and non-drugs. Therefore, the classification presented here is solely based on the similarity of structure of the compounds to known drugs. Also compounds from completely new classes are likely to be wrongly classified. Another important limitation of computationally predicted drug-likeness is that it does not predict the biological/pharmacological activity of a compound. Wet bench methods are required to validate the biological/pharmacological activity.

In summary, the dataset presented here will probably be most useful in lead discovery where they could be used for prioritizing compounds for synthesis or for purchasing from external suppliers.

Data availability

Underlying data

Harvard Dataverse: Underlying data for 'The Computationally predicted drug-likeness, pharmacokinetics properties, medicinal chemistry parameters, and toxicity properties of Cucurbita maxima compounds'. <https://doi.org/10.7910/DVN/4ISBWI> (Shoko, 2022).

This project contains the following underlying data:

- Data file 1. (Druglikeness Properties of *C. maxima* natural compounds.)
- Data file 2. (Medicinal Chemistry Properties of *C. maxima* natural compounds.)
- Data file 3. (Pharmacokinetics Properties of *C. maxima* compounds.)
- Data file 4. (Toxicity Properties of *C. maxima* compounds.)

Data are available under the terms of the [CC0 1.0 Universal](#) (CC0 1.0)

Public Domain Dedication.

References

- Daina A, Michielin O, Zoete V: **SwissADME: A free web tool to evaluate pharmacokinetics, drug-likeness and medicinal chemistry friendliness of small molecules.** *Sci. Rep.* 2017; **7**(1): Article 1.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Greenwell M, Rahman PKSM: **Medicinal Plants: Their Use in Anticancer Treatment.** *Int. J. Pharm. Sci. Res.* 2015; **6**(10): 4103–4112.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Kujawska M, Pieroni A: **Plants used as food and medicine by Polish migrants in Misiones, Argentina.** *Ecol. Food Nutr.* 2015; **54**(3): 255–279.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Lipinski CA, Lombardo F, Dominy BW, *et al.*: **Experimental and computational approaches to estimate solubility and permeability in drug discovery and development settings.** *Adv. Drug Deliv. Rev.* 1997; **23**(1): 3–25.
[Publisher Full Text](#)
- Mahomoodally MF, Mootoosamy A, Wambugu S: **Traditional Therapies Used to Manage Diabetes and Related Complications in Mauritius: A Comparative Ethnoreligious Study.** *Evid. Based Complement. Alternat. Med.* 2016; **2016**: 4523825–4523828.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Marxer M, Ingram K, Keiser J: **Development of an in vitro drug screening assay using *Schistosoma haematobium* schistosomula.** *Parasit. Vectors.* 2012; **5**(1): 165.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Menendez-Baceta G, Aceituno-Mata L, Molina M, *et al.*: **Medicinal plants traditionally used in the northwest of the Basque Country (Biscay and Alava), Iberian Peninsula.** *J. Ethnopharmacol.* 2014; **152**(1): 113–134.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Mtemeli FL, Walter I, Tinago T, *et al.*: **An assessment of the molluscicidal potential of *Cucurbita maxima* seed extracts on *Biomphalaria pfeifferi* and *Bulinus globosus* snails.** *All Life.* 2021; **14**(1): 244–255.
[Publisher Full Text](#)
- Salehi B, Sharifi-Rad J, Capanoglu E, *et al.*: ***Cucurbita* Plants: From Farm to Industry.** *Appl. Sci.* 2019; **9**(16): Article 16.
[Publisher Full Text](#)
- Sander T, Freyss J, von Korff M, *et al.*: **DataWarrior: An Open-Source Program For Chemistry Aware Data Visualization And Analysis.** *J. Chem. Inf. Model.* 2015; **55**(2): 460–473.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Shoko R: **Computationally predicted drug-likeness, pharmacokinetics properties, medicinal chemistry parameters, and toxicity properties of *Cucurbita maxima* compounds.** *Harvard Dataverse, V1.* 2022.
[Publisher Full Text](#)
- Sorescu A-A, Nuță A, Ion R-M: **Qualitative Screening of Phytocompounds and Spectrophotometric Investigations of Two Pumpkin Species.** *Biol. Life Sci. Forum.* 2020; **4**(1). Article 1.
[Publisher Full Text](#)
- Süntar I: **Importance of ethnopharmacological studies in drug discovery: Role of medicinal plants.** *Phytochem. Rev.* 2020; **19**(5): 1199–1209.
[Publisher Full Text](#)

Open Peer Review

Current Peer Review Status:  

Version 1

Reviewer Report 29 April 2024

<https://doi.org/10.5256/f1000research.139601.r262625>

© 2024 Dubey G. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



Gurudutt Dubey

¹ Indian Institute of Technology (IIT), Palaj, Gujarat, India

² Universidad Catolica de Valencia San Vicente Martir (Ringgold ID: 83140), Valencia, Valencian Community, Spain

This data not summaries the computationally predicted ADME and toxicity parameters of *Cucurbita maxima*. Author has used SwissADME and DataWarrior tools to generate the database. Introduction is well written but incorporation of some latest references is recommended. At some places, full form of the abbreviations are missing for e.g. CADD. I will suggest to incorporate ADME and toxicity parameters calculated using other tools than SwissADME as well. It will be helpful to understand the variability in the parameters calculated using various tools.

Is the rationale for creating the dataset(s) clearly described?

Yes

Are the protocols appropriate and is the work technically sound?

Yes

Are sufficient details of methods and materials provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Drug Discovery, Medicinal Chemistry, Computer-aided drug design, computational chemistry, RNA biology

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 21 February 2024

<https://doi.org/10.5256/f1000research.139601.r230597>

© 2024 López-López E. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



Edgar López-López 

Department of Chemistry and Graduate Program in Pharmacology, Center for Research and Advanced Studies of the National Polytechnic Institute,, Mexico City, Mexico

Dear author,

I consider this "data note" to be interesting and transcendent. This work presents a dataset of properties of pharmaceutical interest of molecules present in *Curcubita maxima*, which could be of interest to those research groups that plan to isolate, synthesize, or acquire any of these molecules for subsequent trials. However, I consider that some minor comments should be resolved :

1. Introduction section: About the sentence "... occupy portions of the chemical space that is usually not covered by most synthetic drugs". I suggest adding most recent references that support it. I share with you examples that could be useful: (Saldívar-G et al, 2019)[Ref 1] ,(Sorokina M et al, 2021) [Ref 2], (Medina-Franco JL et al, 2022) [Ref 3], (López-Pérez K et al, 2023) [Ref 4]
2. Introduction section: The abbreviation "CADD" could be unclear for "non-expert readers", I suggest adding the explicit significance of this.
3. Please change "SMILE" to "SMILES".
4. I suggest citing this "technology evaluation" article that complements the original Data Warrior reference: (López-López et al, 2019) [Ref 5]
5. Please, add a reference that supports the sentence "Another important limitation of computationally predicted drug-likeness is that it does not predict the biological/pharmacological activity of a compound. "
6. Scientific names (e.g. *Curcubita maxima*) must be written using italic style.

References

1. Saldívar-González FI, Valli M, Andricopulo AD, da Silva Bolzani V, et al.: Chemical Space and Diversity of the NuBBE Database: A Chemoinformatic Characterization. *J Chem Inf Model*. 2019; **59** (1): 74-85 [PubMed Abstract](#) | [Publisher Full Text](#)
2. Sorokina M, Merseburger P, Rajan K, Yirik MA, et al.: COCONUT online: Collection of Open Natural Products database. *J Cheminform*. 2021; **13** (1): 2 [PubMed Abstract](#) | [Publisher Full Text](#)

3. Medina-Franco JL, Chávez-Hernández AL, López-López E, Saldívar-González FI: Chemical Multiverse: An Expanded View of Chemical Space. *Mol Inform.* 2022; **41** (11): e2200116 [PubMed Abstract](#) | [Publisher Full Text](#)
4. López-Pérez K, López-López E, Medina-Franco JL, Miranda-Quintana RA: Sampling and Mapping Chemical Space with Extended Similarity Indices. *Molecules.* 2023; **28** (17). [PubMed Abstract](#) | [Publisher Full Text](#)
5. López-López E, Naveja JJ, Medina-Franco JL: DataWarrior: an evaluation of the open-source drug discovery tool. *Expert Opin Drug Discov.* 2019; **14** (4): 335-341 [PubMed Abstract](#) | [Publisher Full Text](#)

Is the rationale for creating the dataset(s) clearly described?

Yes

Are the protocols appropriate and is the work technically sound?

Partly

Are sufficient details of methods and materials provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Cheminformatics, Natural products, Drug design, Drug development, Computer-aided drug design.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com

F1000Research