IN SILICO SCREENING OF POTENTIAL MATRIX METALLOPROTEINASE FROM LEMONGRASS

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INTRODUCTION

iGEMDOCK©, also known as a Graphical Environment for Recognizing Pharmacological Interactions and Virtual Screening was developed by BioXGEM Lab in 2006. It was developed in order to provide a user-friendly graphic interface software for the docking, virtual screening, and post-screening analysis of lead pharmacological compounds and understand its corresponding ligand binding mechanisms. This preliminary study can serve as a guide in the selection of the plant materials for experimental validation and the basis for the synthesis of the natural product analogues.

Natural products have been a major source of potentially active pharmacological compounds. *Andropogon citratus* has been traditionally used as a herbal medicine for the remedy of various ailments. Recent scientific studies have shown that it has antimicrobial, anti-inflammatory, and antioxidant properties[1,2]. Matrix metalloproteinase on the other hand is involved in different physiological processes such as wound healing, inflammatory processes, angiogenesis, and bone development [3,4,5,6]. Hence, this research would like to investigate via in silico screening if the compounds isolated from *Andropogon citratus* will have an inhibitory effect on the matrix metalloproteinase.

METHODOLOGY

SAMPLE COLLECTION
RETRIEVAL OF MATRIX METALLOPROTEIN STRUCTURES

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***IN SILICO* SCREENING OF POTENTIAL MMPS INHIBITOR**

RESULTS

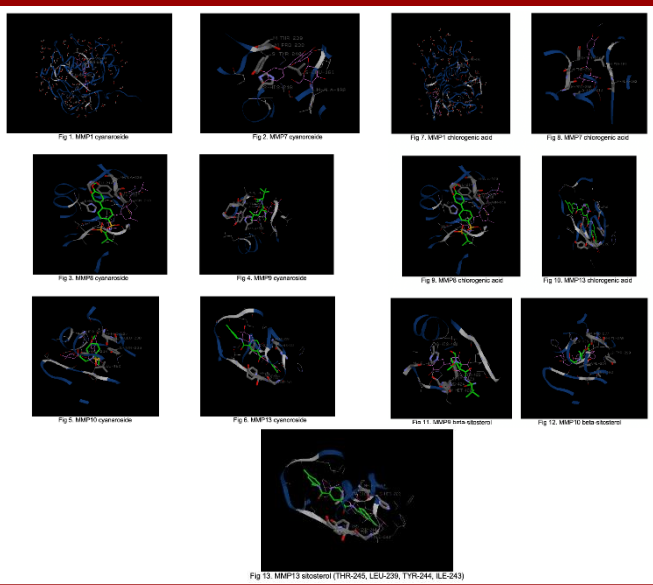

Fig 1. MMP1 cyanaroside | Fig 2. MMP7 cyanoroside | Fig 7. MMP1 chlorogenic acid | Fig 8. MMP7 chlorogenic acid

Fig 3. MMP8 cyanaroside | Fig 4. MMP9 cyanaroside | Fig 9. MMP9 chlorogenic acid | Fig 10. MMP13 chlorogenic acid

Fig 5. MMP10 cyanaroside | Fig 6. MMP13 cyanoroside | Fig 11. MMP9 beta sitosterol | Fig 12. MMP10 beta sitosterol

Fig 13. MMP13 sitosterol (THR-245, LEU-239, TYR-244, ILE-243)

Compounds	Binding energy for each matrix metalloproteinase (Total Energy kcal/mole)						
	MMP1	MMP3	MMP7	MMP8	MMP9	MMP'10	MMP13
Doxycycline (standard)	-105.627	-113.636	-111.318	-116.55	-112.626	-104.053	-117.715
Rebimastat (standard)	-122.954	-105.93	-119.724	-103.928	-109.021	-118.46	-112.052
3,7-DIMETHYL-1,3,6-OCTATRIENE	-57.2991	-66.2588	-58.9346	-70.4313	-66.8348	-62.0768	-69.7875
Alpha-Humulene	-63.9166	-74.0805	-63.3516	-77.2472	-65.7669	-68.6396	-70.2575
beta-caryphyllene	-63.6563	-68.1916	-67.9758	-67.0758	-70.0202	-72.4285	-68.3528
Beta-Eudesmol	-77.0287	-93.1514	-76.5273	-92.5818	-91.7821	-84.4616	-88.5005
chlorogenic acid	-104.184	-142.281	-117.584	-142.673	-118.818	-116.977	-133.334
cis-chrysanthenol	-60.5436	-63.8881	-62.3152	-62.9087	-62.6603	-68.8391	-68.9689
citral diethylacetal	-73.2644	-94.1996	-76.6913	-93.1194	-93.5612	-92.9914	-92.4622
Citronella	-62.4038	-73.8919	-63.8065	-82.4742	-74.8772	-73.6796	-75.9456
Citronellol	-69.1121	-78.3448	72.6454	-84.2212	-82.6466	-75.4117	-77.0609
Catechol	-71.1618	-77.5877	-72.7142	-83.5306	-79.8073	-71.9309	-77.2504
Elemicin	-71.2041	-77.8231	-72.3833	-83.222	-81.991	-73.4401	-77.0783
Fenchone	-57.6348	-58.9865	-58.6946	-59.655	-58.0773	-65.1685	-60.8376
Myrcene	-58.257	-66.2703	-58.8753	-73.0003	-66.883	-63.823	-70.1948
(-)-Isopulegol	-62.5411	-76.9916	-66.6133	-85.2543	-79.6546	-75.1884	-80.6385
beta-Sitosterol	-98.7444	-139.572	-98.6677	-114.488	-122.692	-117.022	-142.037
4-Hydroxycinnamic acid	-85.717	-84.3287	-60.6442	-122.82	-86.7667	-82.7541	-78.9854
Geranial	-69.1219	-74.2737	-69.6606	-95.0301	-76.3322	-68.6854	-75.5337
Neral	-67.0496	-71.2188	-65.286	-82.5315	-72.0167	-72.8244	-72.539
caffeic acid	-91.6837	-87.4563	-68.8877	-81.437	-92.347	-94.0409	-82.318
Luteolin (aglycone)	-100.789	-122.529	-104.784	-102.881	-125.072	-108.731	-124.755
Cynaroside (glycoside)	-120.346	-150.043	-120.029	-133.542	-129.573	-139.315	-166.742
Fucosterol	-94.7208	-138.321	-97.1839	-155.206	-124.662	-111.996	-120.107
beta-bisabolene	-71.7693	-91.4625	-75.5798	-121.672	-90.8231	-81.1259	-91.2442
Isobisabolene	-74.0521	-90.0099	-75.3579	-96.5755	-87.6863	-81.1259	-91.7146
cubebol	-82.7146	-79.8792	-77.9705	-99.233	-78.344	-79.6988	-79.2119
Decanal	-71.3342	-73.8218	-64.0374	-80.223	-76.0173	-71.6646	-73.8576
elemol	-80.9035	-94.7289	-80.8632	-91.5109	-92.8678	-83.872	-90.1366
Enantio-7(11)-Eudesmen-4-ol	-73.3379	-85.086	-63.5971	-92.5272	-85.2974	-75.7172	-79.8059
Geranic acid	-82.285	-80.8889	-74.7736	-90.7364	-82.6476	-81.0494	-74.7867
geranyl acetate	-78.5964	-85.0146	-76.2683	-89.3064	-90.6118	-81.616	-90.709
Linalool	-71.0697	-77.2497	-62.7618	-78.6679	-75.5786	-74.336	-79.3977
linalyl acetate	-71.4628	-63.0632	-78.5063	-69.6929	-85.7145	-83.0132	-86.8423
Methylheptenone	-62.4074	-87.9361	-56.6553	-96.5646	-63.3026	-63.3891	-65.8738
Neointermedeol	-73.7383	-75.9294	-76.4057	-84.7421	-82.8253	-80.946	-89.1251
Nerol	-69.5728	-66.163	-71.1181	-71.991	-77.8937	-78.9537	-78.3873
Ocimene	-57.3592	-124.135	-59.2043	-80.223	-66.7472	-62.288	-69.9404
Orientin	-113.981	-64.9391	-101.118	-119.866	-109.773	-126.552	-116.634
sabinene	-56.6121	-93.3736	-57.2492	-70.0189	-65.1768	-62.5133	-67.6302
selina-6-en-ol	-74.9374	-62.9921	-76.5252	-92.4753	-85.6778	-84.7176	-88.5648
Sulcatone	-59.8745	-78.0097	-56.9997	-69.5439	-63.3095	-63.0534	-66.197
Terpineol	-67.1968	-54.2954	-66.8985	-82.3925	-75.0128	-74.4161	-79.8629
Valeric acid	-64.6337	-66.2588	-43.9204	-57.2181	-46.531	-60.7405	-52.2089

Table 2: Summary of MMPs inhibition of some isolated compounds from Lemongrass
Legend: highlighted box indicates the top 3 potential inhibitors based on binding energy, green (1st), orange (2nd), and yellow (3rd)

DISCUSSION

Wound healing is a complex biological process that consists of homeostasis, inflammation, proliferation, and remodeling [13,14,15]. Due to the diversity of possible processes involved, new therapeutic agents that may accelerate the time required are needed. In this study, a computer-based approach[16] was performed to identify the potential application of isolated secondary metabolites from some Filipino function foods in inhibiting the matrix metalloproteinase (MMPs-1,3,8,9,10, and 13) activities. The results have shown that a few secondary metabolites such as cynaroside from Tanglad (-120.35 to -166.740 kcal/mole) have a higher docking scores as compared to reference inhibitors, rebimastat (-105.93 to -122.95 kcal/mole) and doxycycline (-105.63 to -117.72 kcal/mole) which suggests that the natural products can potentially inhibit the enzymes. This preliminary study can serve as a guide in the selection of the plant materials for experimental validation and the basis for the synthesis of the natural product analogues.

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