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Graph theoretical network analysis, *in silico* exploration, and validation of bioactive compounds from *Cynodon dactylon* as potential neuroprotective agents against α-synuclein

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Supplementary file 1

Table S1: The results of threshold parameter values of the α-Syn network analysis

Gene	Betweenness	Closeness	Degree	Eccentricity	Eigenvector	Radiality	Stress
SNCA	3257.848	0.0418	11	0.6216	0.06054	61.29496	4914
RPS27A	167.1727	0.016949153	4	0.1666	4.51E-17	3	260
RPS27A	204.3364	0.020408163	4	0.2	6.28E-17	3.071942446	340
PRKN	285.3091	0.025	7	0.2	-3.12E-16	2.935251799	434
PARK7	1561.542	0.001455604	6	0.0476	0.551254632	9.561151079	3116

CYCS	3871.904	0.001858736	5	0.0588	0.040035872	10.43165468	6952
NDUFC2-KCTD14...	3681.304	0.001980198	5	0.0714	0.0028394	10.66906475	6242
UQCR11	34	0.058823529	3	0.25	6.71E-19	1.489208633	34
ATP5PD	34	0.058823529	3	0.25	1.90E-19	1.489208633	34
HTRA2	258.75	0.001706485	3	0.0555	0.015538726	10.08633094	426
RPS27A	84.94545	0.016666667	4	0.1666	-6.35E-17	2.992805755	180
RPS27A	51.04545	0.01369863	3	0.1428	-3.05E-18	2.899280576	118
C03758	490.5	0.001035197	4	0.04	3.24E-08	7.553956835	636
C00013	70.5	0.015384615	3	0.1428	5.56E-18	2.755395683	106
TH	824.8075	0.001169591	3	0.0434	2.02E-07	8.151079137	1234
CASP9	2732.904	0.001727116	4	0.0555	0.065971543	10.13669065	5322
DRD1	3632.763	0.001934236	3	0.0714	4.29E-04	10.58273381	6112
ADCY5	669.5	0.001449275	3	0.0555	1.01E-05	9.539568345	1042
C03758	3958.88	0.001858736	4	0.0625	2.02E-04	10.63309353	6398
EIF2AK3	1501.807	0.001355014	3	0.0476	1.43E-06	8.992805755	2182
HSPA5	2173.548	0.001477105	5	0.05	3.58E-06	9.431654676	3230
PSMA8	135.0818	0.02	4	0.1666	-1.39E-16	2.863309353	240
ITPR1	2478.815	0.001677852	4	0.0555	1.70E-05	10.01438849	3732
CALML6	426.3333	0.001592357	3	0.0555	1.47E-05	9.784172662	634
BAX	908.7	0.001647446	4	0.0555	0.018631432	9.935251799	1634
BCL2L1	466.5333	0.001531394	3	0.0526	0.00733911	9.604316547	838
TP53	2300.904	0.00154321	3	0.05	0.35000602	9.64028777	4864
DAXX	705.7913	0.001428571	4	0.0476	0.439269114	9.26618705	1730

MAP3K5	1046.877	0.001349528	3	0.0454	0.367742966	8.971223022	2926
NFE2L2	335.7559	0.001324503	3	0.0454	0.226062151	8.870503597	702
SLC18A1	205.4742	0.001490313	3	0.0588	2.79E-05	9.676258993	426
TXN2	994.0108	0.00124533	4	0.0434	0.186722089	8.726618705	2694
C22381	135.7	0.001153403	3	0.0416	0.099878202	8.064748201	552

Table S2. Details of bonding interactions between selected bioactive compounds and standard drug levodopa with α-Syn

Compounds	**Residues**	**AA**	**Distance (Å)**	**Bond category**
Vitexin	43A	LYS	3.68	Hydrophobic
	48A	VAL	3.68	Hydrophobic
	48A	VAL	3.73	Hydrophobic
	32A	LYS	2.68	Hydrogen
	40A	VAL	3.06	Hydrogen
	45A	LYS	3.08	Hydrogen
Homoorientin	32A	LYS	3.15	Hydrogen
	35A	GLU	2.19	Hydrogen
	36A	GLY	2.42	Hydrogen
	43A	LYS	2.91	Hydrogen
	39A	TYR	5.43	π-Stacking
Friedlein	39A	TYR	3.75	Hydrophobic
	40A	VAL	3.61	Hydrophobic
	43A	LYS	3.89	Hydrophobic
	45A	LYS	3.63	Hydrophobic
	45A	LYS	3.72	Hydrophobic
	48A	VAL	3.34	Hydrophobic
	48A	VAL	3.40	Hydrophobic
Beta-carotene	113A	LEU	3.63	Hydrophobic
	113A	LEU	3.76	Hydrophobic
	117A	PRO	3.54	Hydrophobic
	124A	ALA	3.85	Hydrophobic
	125A	TYR	3.70	Hydrophobic
	125A	TYR	3.61	Hydrophobic
	125A	TYR	3.75	Hydrophobic
	136A	TYR	3.73	Hydrophobic
Orientin	136A	TYR	3.46	Hydrogen
	126A	GLU	3.30	Hydrophobic
	126A	GLU	3.81	Hydrophobic
	126A	GLU	3.81	Hydrophobic
	126A	GLU	3.36	Hydrophobic
	128A	PRO	2.33	Hydrophobic
	132A	GLY	3.21	Hydrophobic

	136A	TYR	3.14	Hydrophobic
Triterpenoids	40A	VAL	3.77	Hydrophobic
	40A	VAL	3.62	Hydrophobic
	43A	LYS	3.95	Hydrophobic
	45A	LYS	3.74	Hydrophobic
	45A	LYS	3.69	Hydrophobic
	48A	VAL	3.42	Hydrophobic
Ergonovine	125A	TYR	3.58	Hydrophobic
	125A	TYR	3.68	Hydrophobic
	125A	TYR	3.85	Hydrophobic
	126A	GLU	3.56	Hydrophobic
	123A	GLU	1.95	Hydrogen
	129A	SER	2.33	Hydrogen
Luteolin	39A	TYR	3.70	Hydrophobic
	40A	VAL	3.61	Hydrophobic
	43A	LYS	3.58	Hydrophobic
	35A	GLU	2.25	Hydrogen
	35A	GLU	2.24	Hydrogen
	43A	LYS	2.26	Hydrogen
	45A	LYS	2.95	Hydrogen
Ergometrinine	35A	GLU	3.83	Hydrophobic
	40A	VAL	3.73	Hydrophobic
	43A	LYS	3.54	Hydrophobic
	44A	THR	3.34	Hydrophobic
	32A	LYS	2.98	Hydrogen
	43A	LYS	2.06	Hydrogen
	44A	THR	2.18	Hydrogen
	45A	LYS	2.36	Hydrogen
	45A	LYS	3.61	Hydrogen
	43A	LYS	5.14	Π-cation interactions
	43A	LYS	5.13	Π-cation interactions
Phytosterols	32A	LYS	2.22	Hydrogen
2"-O-Glycosylisovitexin	39A	TYR	3.67	Hydrophobic
	40A	VAL	3.85	Hydrophobic
	32A	LYS	2.36	Hydrogen
	36A	GLY	2.39	Hydrogen
Arundoin	125A	TYR	3.84	Hydrophobic
	125A	TYR	3.84	Hydrophobic
	126A	GLU	3.78	Hydrophobic
	136A	TYR	3.87	Hydrophobic
	136A	TYR	3.42	Hydrophobic
Apigenin	39A	TYR	3.54	Hydrophobic
	40A	VAL	3.88	Hydrophobic
	40A	VAL	3.63	Hydrophobic
	43A	LYS	3.69	Hydrophobic
	43A	LYS	3.76	Hydrophobic
	35A	GLU	2.66	Hydrogen
	44A	THR	2.04	Hydrogen

Tricin	39A	TYR	3.66	Hydrophobic
	40A	VAL	3.86	Hydrophobic
	38A	LEU	2.17	Hydrogen
Beta-Ionene	35A	GLU	3.73	Hydrophobic
	40A	VAL	3.43	Hydrophobic
	43A	LYS	3.68	Hydrophobic
	45A	LYS	4.00	Hydrophobic
2-Coumarinate	125A	TYR	3.48	Hydrophobic
	126A	GLU	3.55	Hydrophobic
	126A	GLU	2.33	Hydrogen
	127A	MET	2.46	Hydrogen
	128A	PRO	2.10	Hydrogen
	132A	GLY	2.72	Hydrogen
	125A	TYR	4.62	Π-Stacking
Triglochinin	125A	TYR	3.96	Hydrophobic
	125A	TYR	3.08	Hydrogen
	126A	GLU	2.56	Hydrogen
	126A	GLU	2.77	Hydrogen
	126A	GLU	1.94	Hydrogen
	126A	GLU	2.69	Hydrogen
	129A	SER	3.26	Hydrogen
Ferulic acid	35A	GLU	3.66	Hydrophobic
	35A	GLU	3.86	Hydrophobic
	43A	LYS	3.91	Hydrophobic
	32A	LYS	2.27	Hydrogen
	40A	VAL	2.24	Hydrogen
	43A	LYS	2.09	Hydrogen
Phenyl acetaldehyde	35A	GLU	3.95	Hydrophobic
	39A	TYR	3.77	Hydrophobic
	40A	VAL	3.74	Hydrophobic
	40A	VAL	3.79	Hydrophobic
	43A	LYS	3.68	Hydrophobic
	43A	LYS	4.00	Hydrophobic
Syringic acid	125A	TYR	3.56	Hydrophobic
	125A	TYR	2.73	Hydrogen
	126A	GLU	3.15	Hydrogen
	126A	GLU	2.29	Hydrogen
Vanillic acid	126A	GLU	3.93	Hydrophobic
	130A	GLU	3.71	Hydrophobic
	126A	GLU	3.08	Hydrogen
	129A	SER	3.20	Hydrogen
L-ascorbic acid	36A	GLY	2.09	Hydrogen
	36A	GLY	2.25	Hydrogen
	40A	VAL	2.42	Hydrogen
	40A	VAL	2.42	Hydrogen
Phytol	35A	GLU	3.73	Hydrophobic
	39A	TYR	3.68	Hydrophobic
	39A	TYR	3.64	Hydrophobic

	40A	VAL	3.76	Hydrophobic
	43A	LYS	3.71	Hydrophobic
	32A	LYS	2.29	Hydrogen
Palmitic acid	40A	VAL	3.58	Hydrophobic
	43A	LYS	3.67	Hydrophobic
	45A	LYS	3.85	Hydrophobic
	45A	LYS	3.53	Hydrophobic
	48A	VAL	3.77	Hydrophobic
	49A	VAL	3.66	Hydrophobic
	40A	VAL	2.47	Hydrogen
	40A	VAL	2.29	Hydrogen
Docosanoic acid	39A	TYR	3.72	Hydrophobic
	39A	TYR	3.55	Hydrophobic
	40A	VAL	3.88	Hydrophobic
	43A	LYS	3.55	Hydrophobic
	43A	LYS	3.76	Hydrophobic
	45A	LYS	3.72	Hydrophobic
	48A	VAL	3.62	Hydrophobic
	48A	VAL	3.67	Hydrophobic
	48A	VAL	3.66	Hydrophobic
	52A	VAL	2.75	Hydrogen
Hexadecanal	35A	GLU	3.67	Hydrophobic
	40A	VAL	3.65	Hydrophobic
	43A	LYS	3.93	Hydrophobic
	44A	THR	3.94	Hydrophobic
Tritriacontane	29A	ALA	3.99	Hydrophobic
	32A	LYS	3.69	Hydrophobic
	32A	LYS	3.58	Hydrophobic
	33A	THR	3.80	Hydrophobic
	39A	TYR	3.73	Hydrophobic
	40A	VAL	3.67	Hydrophobic
	43A	LYS	3.68	Hydrophobic
	43A	LYS	3.69	Hydrophobic
	45A	LYS	3.80	Hydrophobic
Furfuryl alcohol	126A	GLU	3.86	Hydrophobic
	130A	GLU	3.90	Hydrophobic
	126A	GLU	2.53	Hydrogen
	128A	PRO	2.31	Hydrogen
Furfural	43A	LYS	3.73	Hydrophobic
	43A	LYS	3.82	Hydrophobic
	40A	VAL	1.87	Hydrogen

Table S3. *In silico* predicted physicochemical and ADME parameters of bioactive compounds

Parameter	**Friedlein**

Formula	$C_{30}H_{50}O$
MW ($g.mol^{-1}$)	426.72
Num. heavy atoms	31
Num. arom. heavy atoms	0
Fraction Csp3	0.97
Num. rotatable bonds	0
Num. H-bond acceptors	1
Num. H-bond donors	0
Molar Refractivity	134.39
TPSA ($Å^2$)	17.07
Solubility class	Poorly soluble
GI absorption	Low
BBB permeation	No
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.55
Synthetic accessibility	5.17
Parameter	**Beta-carotene**
Formula	$C_{40}H_{56}$
MW (g.mol-1)	536.87
Num. heavy atoms	40
Num. arom. heavy atoms	0
Fraction Csp3	0.45
Num. rotatable bonds	10
Num. H-bond acceptors	0
Num. H-bond donors	0
Molar Refractivity	184.43
TPSA ($Å^2$)	247.375
Solubility class	Poorly soluble
GI absorption	Low
BBB permeation	No

Violation of Lipinski's rule of five	0
Bioavailability Score	0.17
Synthetic accessibility	5.17
Parameter	**Orientin**
Formula	$C_{21}H_{20}O_{11}$
MW ($g.mol^{-1}$)	448.38
Num. heavy atoms	32
Num. arom. heavy atoms	16
Fraction Csp3	0.29
Num. rotatable bonds	3
Num. H-bond acceptors	11
Num. H-bond donors	8
Molar Refractivity	108.63
TPSA ($Å^2$)	201.28
Solubility class	Soluble
GI absorption	Low
BBB permeation	No
Violation of Lipinski's rule of five	No; 2 violations: NorO>10, NHorOH>5
Bioavailability Score	0.17
Synthetic accessibility	5.17
Parameter	**Triterpenoids**
Formula	$C_{29}H_{44}O_5$
MW ($g.mol^{-1}$)	472.66
Num. heavy atoms	34
Num. arom. heavy atoms	0
Fraction Csp3	0.83
Num. rotatable bonds	1
Num. H-bond acceptors	5

Num. H-bond donors	4
Molar Refractivity	133.99
TPSA (Å²)	97.99
Solubility class	Moderately soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.56
Synthetic accessibility	6.35
Parameter	**Ergonovine**
Formula	$C_{19}H_{23}N_3O_2$
MW (g.mol^{-1})	325.40
Num. heavy atoms	24
Num. arom. heavy atoms	9
Fraction Csp3	0.42
Num. rotatable bonds	4
Num. H-bond acceptors	3
Num. H-bond donors	3
Molar Refractivity	98.56
TPSA (Å²)	68.36
Solubility class	Soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	4.27
Parameter	**Luteolin**
Formula	$C_{15}H_{10}O_6$

MW ($g.mol^{-1}$)	286.24
Num. heavy atoms	21
Num. arom. heavy atoms	16
Fraction Csp3	0.00
Num. rotatable bonds	1
Num. H-bond acceptors	6
Num. H-bond donors	4
Molar Refractivity	76.01
TPSA ($Å^2$)	111.13
Solubility class	Soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	3.02
Parameter	**Ergometrinine**
Formula	$C_{19}H_{23}N_3O_2$
MW ($g.mol^{-1}$)	325.40
Num. heavy atoms	24
Num. arom. heavy atoms	9
Fraction Csp3	0.42
Num. rotatable bonds	4
Num. H-bond acceptors	3
Num. H-bond donors	3
Molar Refractivity	98.56
TPSA ($Å^2$)	68.36
Solubility class	Soluble
GI absorption	High

BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	4.27
Parameter	**Phytosterols**
Formula	$C_{29}H_{50}O$
MW ($g.mol^{-1}$)	414.71
Num. heavy atoms	30
Num. arom. heavy atoms	0
Fraction Csp3	0.93
Num. rotatable bonds	6
Num. H-bond acceptors	1
Num. H-bond donors	1
Molar Refractivity	133.23
TPSA ($Å^2$)	20.23
Solubility class	Poorly soluble
GI absorption	Low
BBB permeation	No
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.55
Synthetic accessibility	6.30
Parameter	**2''-O-Glycosylisovitexin**
Formula	$C_{27}H_{30}O_{15}$
MW ($g.mol^{-1}$)	594.52
Num. heavy atoms	42
Num. arom. heavy atoms	16
Fraction Csp3	0.44
Num. rotatable bonds	6

Num. H-bond acceptors	15
Num. H-bond donors	10
Molar Refractivity	138.99
TPSA (Å²)	260.20
Solubility class	Soluble
GI absorption	Low
BBB permeation	**No**
Violation of Lipinski's rule of five	No; 3 violations: MW>500, NorO>10, NHorOH>5
Bioavailability Score	0.17
Synthetic accessibility	6.38
Parameter	**Arundoin**
Formula	$C_{31}H_{52}O$
MW ($g.mol^{-1}$)	440.74
Num. heavy atoms	32
Num. arom. heavy atoms	0
Fraction Csp3	0.94
Num. rotatable bonds	2
Num. H-bond acceptors	1
Num. H-bond donors	0
Molar Refractivity	139.87
TPSA (Å²)	9.23
Solubility class	Poorly soluble
GI absorption	Low
BBB permeation	No
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.55
Synthetic accessibility	6.24
Parameter	**Apigenin**

Formula	$C_{15}H_{10}O_5$
MW ($g.mol^{-1}$)	270.24
Num. heavy atoms	20
Num. arom. heavy atoms	16
Fraction Csp3	0.00
Num. rotatable bonds	1
Num. H-bond acceptors	5
Num. H-bond donors	3
Molar Refractivity	73.99
TPSA ($Å^2$)	90.90
Solubility class	Soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	2.96
Parameter	**Tricin**
Formula	$C_{17}H_{14}O_7$
MW ($g.mol^{-1}$)	330.29
Num. heavy atoms	24
Num. arom. heavy atoms	16
Fraction Csp3	0.12
Num. rotatable bonds	3
Num. H-bond acceptors	7
Num. H-bond donors	3
Molar Refractivity	86.97
TPSA ($Å^2$)	109.36
Solubility class	Moderately soluble

GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	3.21
Parameter	**Beta-Ionene**
Formula	$C_{13}H_{18}$
MW ($g.mol^{-1}$)	174.28
Num. heavy atoms	13
Num. arom. heavy atoms	6
Fraction Csp3	0.54
Num. rotatable bonds	0
Num. H-bond acceptors	0
Num. H-bond donors	0
Molar Refractivity	58.19
TPSA ($Å^2$)	0.00
Solubility class	Soluble
GI absorption	Low
BBB permeation	Yes
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.55
Synthetic accessibility	1.68
Parameter	**2-Coumarinate**
Formula	$C_9H_8O_3$
MW ($g.mol^{-1}$)	164.16
Num. heavy atoms	12
Num. arom. heavy atoms	6
Fraction Csp3	0.00

Num. rotatable bonds	2
Num. H-bond acceptors	3
Num. H-bond donors	2
Molar Refractivity	45.13
TPSA (Å^2)	57.53
Solubility class	Soluble
GI absorption	High
BBB permeation	Yes
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.85
Synthetic accessibility	1.85
Parameter	**Triglochinin**
Formula	$C_{14}H_{17}NO_{10}$
MW (g.mol^{-1})	359.29
Num. heavy atoms	25
Num. arom. heavy atoms	0
Fraction Csp3	0.50
Num. rotatable bonds	7
Num. H-bond acceptors	11
Num. H-bond donors	6
Molar Refractivity	76.46
TPSA (Å^2)	197.77
Solubility class	Moderately soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	3.21

Parameter	**Ferulic acid**
Formula	$C_{10}H_{10}O_4$
MW ($g.mol^{-1}$)	194.18
Num. heavy atoms	14
Num. arom. heavy atoms	6
Fraction Csp3	0.10
Num. rotatable bonds	3
Num. H-bond acceptors	4
Num. H-bond donors	2
Molar Refractivity	51.63
TPSA ($Å^2$)	66.76
Solubility class	Soluble
GI absorption	High
BBB permeation	Yes
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.85
Synthetic accessibility	1.93
Parameter	**Phenyl acetaldehyde**
Formula	C_8H_8O
MW ($g.mol^{-1}$)	120.15
Num. heavy atoms	9
Num. arom. heavy atoms	6
Fraction Csp3	0.12
Num. rotatable bonds	2
Num. H-bond acceptors	1
Num. H-bond donors	0
Molar Refractivity	36.42
TPSA ($Å^2$)	17.07

Solubility class	Soluble
GI absorption	High
BBB permeation	Yes
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	1.00
Parameter	**Syringic acid**
Formula	$C_9H_{10}O_5$
MW ($g.mol^{-1}$)	198.17
Num. heavy atoms	14
Num. arom. heavy atoms	6
Fraction Csp3	0.22
Num. rotatable bonds	3
Num. H-bond acceptors	5
Num. H-bond donors	2
Molar Refractivity	48.41
TPSA ($Å^2$)	75.99
Solubility class	Very soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.56
Synthetic accessibility	1.70
Parameter	**Vanillic acid**
Formula	$C_8H_8O_4$
MW ($g.mol^{-1}$)	168.15
Num. heavy atoms	12
Num. arom. heavy atoms	6

Fraction Csp3	0.12
Num. rotatable bonds	2
Num. H-bond acceptors	4
Num. H-bond donors	2
Molar Refractivity	41.92
TPSA (Å²)	66.76
Solubility class	Soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.85
Synthetic accessibility	1.42
Parameter	**L-ascorbic acid**
Formula	$C_6H_8O_6$
MW ($g.mol^{-1}$)	176.12
Num. heavy atoms	12
Num. arom. heavy atoms	0
Fraction Csp3	0.50
Num. rotatable bonds	2
Num. H-bond acceptors	6
Num. H-bond donors	4
Molar Refractivity	35.12
TPSA (Å²)	107.22
Solubility class	Highly soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.56

Synthetic accessibility	3.47
Parameter	**Phytol**
Formula	$C_{20}H_{40}O$
MW ($g.mol^{-1}$)	296.53
Num. heavy atoms	21
Num. arom. heavy atoms	0
Fraction Csp3	0.90
Num. rotatable bonds	13
Num. H-bond acceptors	1
Num. H-bond donors	1
Molar Refractivity	98.94
TPSA ($Å^2$)	20.23
Solubility class	Moderately soluble
GI absorption	Moderately soluble
BBB permeation	No
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.55
Synthetic accessibility	4.30
Parameter	**Palmitic acid**
Formula	$C_{16}H_{32}O_2$
MW ($g.mol^{-1}$)	256.42
Num. heavy atoms	18
Num. arom. heavy atoms	0
Fraction Csp3	0.94
Num. rotatable bonds	14
Num. H-bond acceptors	2
Num. H-bond donors	1
Molar Refractivity	80.80

TPSA (Å²)	37.30
Solubility class	Moderately soluble
GI absorption	High
BBB permeation	Yes
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.85
Synthetic accessibility	2.31
Parameter	**Docosanoic acid**
Formula	$C_{22}H_{44}O_2$
MW (g.mol^{-1})	340.58
Num. heavy atoms	24
Num. arom. heavy atoms	0
Fraction Csp3	0.95
Num. rotatable bonds	20
Num. H-bond acceptors	2
Num. H-bond donors	1
Molar Refractivity	109.64
TPSA (Å²)	37.30
Solubility class	Poorly soluble
GI absorption	Low
BBB permeation	No
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.85
Synthetic accessibility	3.00
Parameter	**Hexadecanal**
Formula	$C_{16}H_{32}O$
MW (g.mol^{-1})	240.42
Num. heavy atoms	17

Num. arom. heavy atoms	0
Fraction Csp3	0.94
Num. rotatable bonds	14
Num. H-bond acceptors	1
Num. H-bond donors	0
Molar Refractivity	79.23
TPSA (Å²)	17.07
Solubility class	Moderately soluble
GI absorption	High
BBB permeation	No
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15
Bioavailability Score	0.55
Synthetic accessibility	2.26
Parameter	**Tritriacontane**
Formula	$C_{33}H_{68}$
MW (g.mol^{-1})	464.89
Num. heavy atoms	33
Num. arom. heavy atoms	0
Fraction Csp3	1.00
Num. rotatable bonds	30
Num. H-bond acceptors	0
Num. H-bond donors	0
Molar Refractivity	160.75
TPSA (Å²)	0.00
Solubility class	Insoluble
GI absorption	Low
BBB permeation	No
Violation of Lipinski's rule of five	Yes; 1 violation: MLOGP>4.15

Bioavailability Score	0.55
Synthetic accessibility	4.32
Parameter	**Furfuryl alcohol**
Formula	$C_5H_6O_2$
MW ($g.mol^{-1}$)	98.10
Num. heavy atoms	7
Num. arom. heavy atoms	5
Fraction Csp3	0.20
Num. rotatable bonds	1
Num. H-bond acceptors	2
Num. H-bond donors	1
Molar Refractivity	24.84
TPSA ($Å^2$)	33.37
Solubility class	Very soluble
GI absorption	High
BBB permeation	Yes
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	1.97
Parameter	**Furfural**
Formula	$C_5H_4O_2$
MW ($g.mol^{-1}$)	96.08
Num. heavy atoms	7
Num. arom. heavy atoms	5
Fraction Csp3	0.00
Num. rotatable bonds	1
Num. H-bond acceptors	2
Num. H-bond donors	0

Molar Refractivity	24.10
TPSA (Å^2)	30.21
Solubility class	Very soluble
GI absorption	High
BBB permeation	Yes
Violation of Lipinski's rule of five	0 violation
Bioavailability Score	0.55
Synthetic accessibility	1.77

Table S4. List of the drug-induced hERG inhibition, AMES toxicity, carcinogens, *Tetrahymena pyriformis* (TP) toxicity, rat acute toxicity (LD_{50} in mol.kg^{-1}), and skin sensitisation along with Minnow toxicity of selected four compounds

Compound ID	AMES toxicity	Max. tolerated dose (human)	hERG inhibition	LD50	Hepatotoxicity	Carcinogenicity	Skin Sensitisation	*T. pyriformis* toxicity	Minnow toxicity
Friedlein	No	0.546	No	2.387	No	No	No	0.336	-3.185
Beta-carotene	Yes	-0.177	No	1.998	No	No	No	0.334	-4.124
Orientin	Yes	0.814	No	2.915	No	No	No	0.285	3.712
Triterpenoids	No	0.29	No	2.916	Yes	No	No	0.285	0.56
Ergonovine	Yes	-0.753	No	2.728	No	No	No	0.298	3.515
Luteolin	No	0.801	No	2.378	No	No	No	0.388	1.545
Ergometrinine	Yes	-0.753	No	2.728	No	No	No	0.298	3.515
Phytosterols	No	-0.341	No	2.854	No	No	No	0.477	-2.079
2"-O-Glycosylisovitexin	Yes	0.584	No	2.568	No	No	No	0.285	4.827
Arundoin	No	0.171	No	2.435	No	No	No	0.331	-3.635
Apigenin	No	0.713	No	2.327	No	No	No	0.458	0.95
Tricin	No	0.709	No	2.436	No	No	No	0.317	0.769
Beta-Ionene	No	0.52	No	1.717	No	No	Yes	1.745	0.193
2-Coumarinate	No	0.446	No	2.402	No	No	No	0.183	1.963
Triglochinin	No	0.633	No	2.08	No	No	No	0.285	4.851
Ferulic acid	No	1.463	No	2.325	No	No	No	0.278	1.952
Phenyl acetaldehyde	No	0.908	No	1.71	No	No	Yes	-0.199	1.345
Syringic acid	No	0.899	No	1.981	Yes	No	No	0.284	1.923
Vanillic acid	No	0.923	No	1.94	No	No	No	0.284	2.144
L-ascorbic acid	No	1.627	No	1.271	No	No	No	0.283	3.046
Phytol	No	0.133	No	1.603	No	No	Yes	1.903	-1.59
Palmitic acid	No	-0.818	No	1.595	No	No	Yes	0.387	-1.083
Docosanoic acid	No	-0.93	No	1.602	Yes	No	Yes	0.308	-2.528
Hexadecanal	No	0.069	No	1.506	No	No	No	1.896	-1.197
Tritriacontane	No	-0.185	No	1.915	No	No	Yes	0.286	-5.503
Furfuryl alcohol	No	1.18	No	2.439	No	No	Yes	-1.208	2.556
Furfural	Yes	1.058	No	2.456	No	No	Yes	-0.859	2.259