

**Dr. Duke's Phytochemical and Ethnobotanical Database**

**Chemicals Found in *Spinacia oleracea***

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
0	2-CARBOXYARABINITOL	Leaf	--	5	-0.8745646032794931	Moore, B. D., Isidoro, E., Seemann, J. R. 1993. Distribution of 2-Carboxyarabinitol Among Plants. <i>Phytochemistry</i> 34 3: 703-707. Dept. Biochem. Univ. Nevada Reno 89557, USA.
0	24(28)-DEHYDROMAKISTERONE	Seed	--	--		
0	3,3',4',5,7-PENTAHYDROXY-6-METHOXYFLAVONE	Leaf	--	--		
0	3-HYDROXYTYRAMINE	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
0	4',5-DIHYDROXY-3,3'-DIMETHOXY-6,7-METHYLENEDIOXYFLAVONE	Leaf	--	--		
0	6-(HYDROXYMETHYL)-LUMAZINE	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
0	6-PHYTYLTOLUQUINOL	Leaf	--	--		
0	7-STIGMASTEROL	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
19	ACETYL-CHOLINE	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
3	ALANINE	Plant	1420	16864	0.5700171464175169	USDA's Ag Handbook 8 and sequelae)
7	ALPHA-CAROTENE	Leaf	--	--		
15	ALPHA-LINOLENIC-ACID	Plant	480	13657	1.4955264890768174	
15	ALPHA-LINOLENIC-ACID	Leaf	--	--		
1	ALPHA-LIPOIC-ACID	Plant	315	3150	1	
2	ALPHA-SPINASTEROL	Leaf	--	--		
32	ALPHA-TOCOPHEROL	Leaf	12	419	0.2913184399571312	
5	ALUMINUM	Leaf	5	270	-0.49080851056065206	ACTA AGRIC SCAND SUPPL 22: 1980
1	AMARANTHIN	Pt	--	--		
0	AMMONIA	Leaf	--	18280	1.1391940589308933	
14	ARGININE	Leaf	--	--		
14	ARGININE	Plant	1620	19239	1.2761740025274024	USDA's Ag Handbook 8 and sequelae)
2	ARSENIC	Leaf	0.02	0.29	0.7318007945426982	ACTA AGRIC SCAND SUPPL 22: 1980
0	ASCORBATE	Plant	212	4450	-1	
112	ASCORBIC-ACID	Plant	239	7595	1.1893099515743446	
112	ASCORBIC-ACID	Leaf	--	--		
112	ASCORBIC-ACID	Fruit Juice	--	55	-1	
0	ASH	Plant	16850	285700	2.9752400785567166	

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
3	ASPARTIC-ACID	Plant	2400	28502	0.5819483717137405	USDA's Ag Handbook 8 and sequelae)
7	ASTRAGALIN	Shoot	--	--		
0	BENZYL-AMINE	Leaf	--	6.1	1.394254707125211	
53	BETA-CAROTENE	Leaf	--	32.5	-0.9964033865662687	
53	BETA-CAROTENE	Plant	4	690	3.0097842607969785	
2	BETA-CRYPTOXANTHIN	Leaf	--	--		
2	BETA-ECDYSONE	Leaf	--	--		
2	BETA-ECDYSONE	Seed	--	214.5		
5	BETANIN	Pt	--	--		
5	BETANIN	Tissue Culture	--	--		
4	BORON	Leaf	2.4	40	-0.5790251325011837	ACTA AGRIC SCAND SUPPL 22: 1980
0	BROMINE	Leaf	4	4	-0.9927156521845423	ACTA AGRIC SCAND SUPPL 22: 1980
3	CADMIUM	Leaf	0.05	5	1.0824728791014093	ACTA AGRIC SCAND SUPPL 22: 1980
102	CAFFEIC-ACID	Shoot	--	--		
102	CAFFEIC-ACID	Leaf	--	--		
28	CALCIUM	Plant	730	15700	0.2257645071195088	

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
1	CALMODULIN	Plant	--	--		Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp.
1	CALMODULIN	Leaf	--	--		
0	CALSEQUESTRIN	Leaf	--	--		
2	CAMPESTEROL	Sprout Seedling	--	--		Spiller, G. A. 1996 (Spiller, G. A. Ed. 1996. CRC Handbook of Lipids in Human Nutrition. CRC Press. Boca Raton, FL. 233 pp.)
0	CARBOHYDRATES	Plant	35000	415660	-1.6530716464562447	USDA's Ag Handbook 8 and sequelae)
0	CARBONIC-ANHYDRASE	Leaf	--	--		
0	CELOSIANIN	Pt	--	--		
1	CEPHALIN	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
7	CHLORINE	Plant	540	6835	0.09562346322025084	ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
77	CHLOROGENIC-ACID	Shoot	--	--		

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
21	CHLOROPHYLL	Leaf	--	--		
21	CHLOROPHYLL	Fruit Juice	--	3		
0	CHLOROPHYLL-A	Leaf	--	--		
1	CHOLESTEROL	Leaf	--	--		
24	CHROMIUM	Flower	0.01	0.42	-1.2060967413329013	ACTA AGRIC SCAND SUPPL 22: 1980
23	CITRIC-ACID	Leaf	--	2300	-0.5219939763024926	Soldatenkov, S. V., Mazurova, T. A., Rantelev, A. N. 1960. Organic Acids of Onion and Spinach. Trudy Petergof Biol. Inst., Leningrad Gosudarst Univ Im AA Zhdanova, 18: 55-61.
2	COBALT	Plant	0.001	1.2	-0.4382119966012714	
0	COLAMINE	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
12	COPPER	Plant	0.1	24	1.1055674700843674	
13	COUMESTROL	Leaf	0.1	100	-1	
0	CYSTATHIONINE	Leaf	--	0.2		
2	CYSTINE	Plant	350	4157	0.9786663998162064	USDA's Ag Handbook 8 and sequelae)
0	DEHYDROASCORBIC-ACID	Leaf	--	--		
2	DIETHYL-AMINE	Leaf	--	15		
0	DIGALACTOSYLDIACYLGLYCEROL	Plant	--	--		

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
3	ECDYSONE	Seed	--	--		
0	ETHYL-AMINE	Leaf	--	8.4	1.0000000000000002	
0	FAT	Plant	3070	46672	-0.07406978675946051	USDA's Ag Handbook 8 and sequelae)
61	FERULIC-ACID	Inflorescence	--	--		
61	FERULIC-ACID	Leaf	16	16	0.37081029570000157	
15	FIBER	Plant	6000	111634	-0.8219381795308445	
0	FLUORINE	Leaf	0.3	5.7	0.5178738172246513	ACTA AGRIC SCAND SUPPL 22: 1980
15	FOLACIN	Plant	1.59	27.13	-0.0465638733379045	USDA's Ag Handbook 8 and sequelae)
23	FOLIC-ACID	Plant	1.2	15	-0.4505134514039695	
8	GLUTAMIC-ACID	Plant	3430	40735	1.5707193839545637	USDA's Ag Handbook 8 and sequelae)
7	GLUTATHIONE	Plant	90	1065		
12	GLYCINE	Plant	1340	15914	1.6896690344750718	USDA's Ag Handbook 8 and sequelae)
0	HEXADECA-7,10,13-TRIENOIC-ACID	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
0	HEXADECATRIENOIC-ACID	Leaf	--	--		

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
0	HEXOSAMINE	Seed	380	380		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
18	HISTAMINE	Plant	--	--		Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp.
7	HISTIDINE	Plant	640	7601	1.1356385926026882	USDA's Ag Handbook 8 and sequelae)
30	HYPEROSIDE	Shoot	--	--		
7	INDOLE-3-ACETIC-ACID	Sprout Seedling	--	--		
12	IODINE	Plant	0.2	0.2	-0.4468248895819287	ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
6	IRON	Leaf	--	--		
6	IRON	Plant	8	384	-0.28609078404129584	
1	ISOBETANIN	Pt	--	--		
0	ISOCELOSIANIN	Pt	--	--		
3	ISOLEUCINE	Plant	1470	17458	1.3309580391447728	USDA's Ag Handbook 8 and sequelae)

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
3	ISOLEUCINE	Leaf	--	--		
0	ISOPENTYL-AMINE	Leaf	--	3.8	0.9999999999999998	
0	JACEIDIN-4'-GLUCURONIDE	Leaf	--	--		
75	KAEMPFEROL	Leaf	--	2	-0.7448470733619753	
75	KAEMPFEROL	Plant	--	--		
0	KILOCALORIES	Plant	220	2613	-0.6337239292634677	USDA's Ag Handbook 8 and sequelae)
1	L-HOMOCYSTEINE	Plant	--	--		Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp.
0	LEAD	Leaf	0.03	3	-0.5904546176203417	ACTA AGRIC SCAND SUPPL 22: 1980
20	LECITHIN	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
2	LEUCINE	Leaf	--	--		
2	LEUCINE	Plant	2230	26483	1.3907214750103931	USDA's Ag Handbook 8 and sequelae)
27	LINOLEIC-ACID	Plant	104	2613	-0.541791899786887	
27	LINOLEIC-ACID	Leaf	--	--		
0	LINOLENIC-ACID	Leaf	--	--		



Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
15	LUTEIN	Leaf	--	42		
4	LYSINE	Leaf	--	--		
4	LYSINE	Plant	1740	20664	1.308971519219775	USDA's Ag Handbook 8 and sequelae)
65	MAGNESIUM	Plant	420	11000	2.1524585904189935	
15	MALIC-ACID	Leaf	--	4300	-0.7530674316188777	Soldatenkov, S. V., Mazurova, T. A., Ranteleev, A. N. 1960. Organic Acids of Onion and Spinach. Trudy Petergof Biol. Inst., Leningrad Gosudarst Univ Im AA Zhdanova, 18: 55-61.
2	MALTOSE	Leaf	--	--		
14	MANGANESE	Plant	3	485	2.7811803446646057	
1	MERCURY	Leaf	0.003	0.11	1.6807373133361998	ACTA AGRIC SCAND SUPPL 22: 1980
15	METHIONINE	Plant	530	6294	2.224241040054928	USDA's Ag Handbook 8 and sequelae)
15	METHIONINE	Leaf	--	--		
1	METHYL-AMINE	Leaf	--	12	-0.9038170440976104	
2	MOLYBDENUM	Plant	0.06	0.8	-0.6403529503457794	ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
0	MONOGALACTOSYLDIACYLGLYCEROL	Plant	--	--		
6	MYRISTIC-ACID	Plant	1	950	-0.34172508190823475	

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
0	N,N-DIMETHYLHISTAMINE	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
0	N-ACETYLHISTAMINE	Leaf	--	--		
0	N-METHYL-ANILINE	Leaf	--	3.4	1.0000000000000002	
0	N-METHYL-PHENETHYLAMINE	Leaf	--	2.4	-0.4133836909571625	
0	N-PENTYL-AMINE	Leaf	--	0.3	-0.8053872662568291	
2	NEO-CHLOROGENIC-ACID	Shoot	--	--		
39	NIACIN	Plant	6.9	89.8	0.18336375742880084	USDA's Ag Handbook 8 and sequelae)
3	NICKEL	Plant	0.05	5.7	-0.37306200253035504	
0	NITROGEN	Leaf	3200	45700	0.09626842491686814	ACTA AGRIC SCAND SUPPL 22: 1980
18	OLEIC-ACID	Plant	18	475	-0.8580334988525617	
18	OLEIC-ACID	Leaf	--	--		
0	OLERAGENOSIDE	Plant	--	0.06		
9	OXALIC-ACID	Leaf	5000	93900	2.2754912851003497	
25	P-COUMARIC-ACID	Leaf	133	133	-0.31505669620268567	
13	PALMITIC-ACID	Plant	106	4869	-0.7374530233038146	
13	PALMITIC-ACID	Leaf	--	--		
2	PALMITOLEIC-ACID	Leaf	--	--		
2	PALMITOLEIC-ACID	Plant	21	475	-1	
11	PANTOTHENIC-ACID	Plant	0.57	8.7	-1.2357577104072583	
2	PATULETIN	Leaf	--	--		
0	PATULETIN-3-O-BETA-D-(2''-FERULOYL-GLUCOPYRANOSYL)-(1,6)-(BETA-D-APIOFURANOSYL-(1,2))-BETA-D-GLUCOPYRANOSIDE	Leaf	--	--		

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
0	PATULETIN-3-O-BETA-D-GLUCOPYRANOSYL-(1,6)-(BETA-D-APIOFURANOSYL-(1,2))-BETA-D-GLUCOPYRANOSIDE	Leaf	--	--		
3	PHENETHYLAMINE	Leaf	--	1.1	-0.9841987738690897	
7	PHENYLALANINE	Plant	1290	15320	1.6518849106475164	USDA's Ag Handbook 8 and sequelae)
7	PHENYLALANINE	Leaf	--	--		
3	PHEOPHYTIN-A	Leaf	--	--		
2	PHOSPHATIDYL-CHOLINE	Plant	--	--		
0	PHOSPHATIDYL-ETHANOLAMINE	Plant	--	--		
0	PHOSPHATIDYL-GLYCEROL	Leaf	--	--		
0	PHOSPHATIDYL-INOSITOL	Leaf	--	--		
0	PHOSPHATIDYL-SERINE	Leaf	--	--		
4	PHOSPHORUS	Plant	250	6232	1.2702244799414446	
5	PHYLLOQUINONE	Tuber	--	3.8	1.0000000000000002	
9	PHYTIC-ACID	Leaf	--	80		
2	PHYTOSTEROLS	Plant	90	1800	1.0768787487624356	
0	PHYTYLPLASTOQUINOL	Leaf	--	--		
0	POLYPHENOL-OXIDASE	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
0	POLYPODINE-B	Seed	--	2.3		
0	POLYPODINE-B	Leaf	--	--		
14	POTASSIUM	Plant	2060	69077	3.297249785037831	
0	PROLINE	Plant	1120	13301	1.2034784447687357	USDA's Ag Handbook 8 and sequelae)

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
0	PROTEIN	Plant	27480	352954	1.4709058523233878	USDA's Ag Handbook 8 and sequelae)
43	PROTocatechuic-acid	Shoot	--	--		
1	pyrrolidine	Leaf	--	2.5		
176	quercetin	Leaf	1	19	-0.35172338839946077	
44	quercitrin	Leaf	--	500	-0.4939476620574426	
15	riboflavin	Plant	1.8	23.4	0.8354117066800743	USDA's Ag Handbook 8 and sequelae)
0	rubidium	Leaf	0.9	90	1.8189036458711207	ACTA AGRIC SCAND SUPPL 22: 1980
87	rutin	Shoot	--	--		
87	rutin	Leaf	170	170	-0.993991147325029	
7	salicylates	Leaf	0.3	60	-0.4464338695640787	
5	saponins	Leaf	--	47000	-0.23418857166033838	Spiller, G. A. 1996 (Spiller, G. A. Ed. 1996. CRC Handbook of Lipids in Human Nutrition. CRC Press. Boca Raton, FL. 233 pp.)
60	selenium	Leaf	--	0.057	-0.3781672517204582	ACTA AGRIC SCAND SUPPL 22: 1980
1	serine	Plant	1040	12351	1.0594826529274783	USDA's Ag Handbook 8 and sequelae)
4	silicon	Leaf	1	855	2.1298618434688388	ACTA AGRIC SCAND SUPPL 22: 1980
1	sodium	Plant	585	10669	0.28651825352805566	
0	spinacetin	Leaf	--	--		
0	spinacetin-3-O-beta-D-(2''-feruloyl-glucopyranosyl)-(1,6)-(beta-D-apiofuranosyl(1,2))-beta-D-glucopyranoside	Leaf	--	--		

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
0	SPINACETIN-3-O-BETA-D-(2''-FERULOYL-GLUCOPYRANOSYL)-(1,6)-BETA-D-GLUCOPYRANOSIDE	Leaf	--	--		
0	SPINACETIN-3-O-BETA-D-(2''-P-COUMAROYL-GLUCOPYRANOSYL)-(1,6)-(BETA-D-APIOFURANOSYL(1,2))-BETA-D-GLUCOPYRANOSIDE	Leaf	--	--		
0	SPINACETIN-3-O-BETA-D-GLUCOPYRANOSYL(1,6)-(BETA-D-APIOFURANOSYL(1,2))-BETA-D-GLUCOPYRANOSIDE	Leaf	--	--		
0	SPINACETIN-3-O-BETA-D-GLUCOPYRANOSYL(1,6)-BETA-D-GLUCOPYRANOSIDE	Leaf	--	--		
0	SPINACOSIDE-A	Root	--	--		
0	SPINACOSIDE-B	Root	--	--		
0	SPINACOSIDE-C	Root	--	--		
0	SPINACOSIDE-C	Shoot	--	10		
0	SPINACOSIDE-D	Root	--	--		
0	SPINACOSIDE-D	Shoot	--	10		
0	SPINASAPONINS	Plant	--	--		
0	SPINASTEROL	Leaf	--	--		
0	SPINASTEROL	Seed	--	--		
0	SPINATOSIDE	Plant	--	--		
8	STEARIC-ACID	Plant	7	356	-0.6655276409333674	
8	STEARIC-ACID	Leaf	--	--		
0	STIGMAST-7-EN-3-BETA-OL-BETA-D-GLUCOSIDE	Shoot	--	--		
0	STRONTIUM	Plant	0.06	0.77	-1.006777905093239	ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
0	SULFOLIPIDS	Plant	--	--		
14	SULFUR	Plant	270	5700	0.782987997507475	
31	THIAMIN	Plant	0.7	10.2	0.2209949208584362	USDA's Ag Handbook 8 and sequelae)

Activity Count	Chemical	Plant Part	Low PPM	High PPM	StdDev	Reference Citation
4	THREONINE	Plant	1220	14489	0.9163251148553258	USDA's Ag Handbook 8 and sequelae)
4	THREONINE	Leaf	--	--		
0	TRIMETHYLHISTAMINE	Leaf	--	--		ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.
29	TRYPTOPHAN	Plant	390	4632	1.4033196129047203	USDA's Ag Handbook 8 and sequelae)
8	TYROSINE	Plant	1080	12826	1.690477622671528	USDA's Ag Handbook 8 and sequelae)
3	VALINE	Plant	1610	19120	1.555158000620152	USDA's Ag Handbook 8 and sequelae)
0	VIT-B-6	Plant	1.9	24	1	USDA's Ag Handbook 8 and sequelae)
0	VIT-K-1	Leaf	--	5		
0	WATER	Plant	913120	930000	0.6809832665754842	
10	XYLITOL	Leaf	--	--		Counsell, J. N., Robertson, D. J. 1976. Xylitol-A Sweetener Which is Kind to the Teeth. Food Process Ind., 45(54): 24-26.
5	ZEAXANTHIN	Leaf	--	4		
77	ZINC	Plant	4	185	1.3103512331616465	