

Biological Activities for Extracts of Yerba maté (*Ilex paraguariensis*)

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Scotland	Death	Hot H2O Ext	Oral Human	Not stated	Active	26 yr old woman taking "mate" tea presented symptoms of abdominal pain & liver function tests abnormal. 3 weeks after admission to hospital died - poor evidence of plant identification most probable cause of illness rather than the herb tea.	A07774
Not Stated Chile	Binding Effect	Infusion	Not stated	Not stated	Active	Binds minerals such as iron, zinc and copper.	AB1020
Leaf Uruguay	Cancer-associated Risk Factor	Infusion	Oral Human	Not stated	Equivocal	Drinking very hot mate may increase risk of oral and esophageal cancers. Increases risk factor to 1.6-fold in heavy chronic drinkers.	18335
Leaf Argentina	Carcinogenic Activity	Infusion	Oral Human	>1.0 L/day	Equivocal	Data analyzed from 830 cases and 1,779 controls participating in a series of 5 hospital-based case control studies of squamous-cell carcinoma of the esophagus conducted in high-risk areas of South America. After adjusting for the strong effects of tobacco and alcohol consumption both heavy maté drinking (>11/day) and self-reported very hot mate drinking were significantly associated with esophageal cancer risk in men and women.	E00552
Leaf Brazil	Carcinogenic Activity	Hot H2O Ext	Oral Human	Not stated	Active	Associated with increased incidence of upper GI cancers.	M30494
Leaf Uruguay	Carcinogenic Activity	Infusion	Oral Human	Not stated	Active	3-fold increased risk of renal cell carcinoma for heavy drinkers.	AB1013
Leaf Uruguay	Carcinogenic Activity	Infusion	Oral Human	Not stated	Inactive	Pulmonary adenocarcinoma.	AB1015
Leaf Brazil	Carcinogenic Activity	Infusion	Oral Human	Not stated	Active	May be linked to 20% of all upper aerodigestive tract cancers in Southern Brazil.	AB1016

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Leaf Uruguay	Carcinogenic Activity	Infusion	Oral Human	Not stated	Active	Increased rate of bladder cancer seen.	AB1017
Leaf Uruguay	Carcinogenic Activity	Infusion	Oral Human	Not stated	Active	Increased rate of oropharyngeal cancer.	AB1018
Leaf Uruguay	Carcinogenic Activity	Infusion	Oral Human	Not stated	Active	Esophageal cancer; 6.5 increased rate for males; 34.6 increased rate for females.	AB1019
Leaf Brazil	Chromosome Aberrations Induced	MEOH Ext	Cell Culture	10.0 mg	Equivocal	Lymphocytes-human.	L14998
Leaf Brazil	Chromosome Aberrations Induced	MEOH Ext	Intragastric Rat Fetus	1.0 gm/kg	Active	Cells-bone marrow.	L14998
Leaf Brazil	Clastogenic Activity	MEOH Ext	Cell Culture	10.0 mg/ml	Equivocal	Lymphocytes-human.	L14998
Leaf Brazil	Genotoxicity Activity	Lyophilized Extract	Agar Plate	150.0 mg	Inactive	<i>Escherichia coli</i>	L14998
Leaf Brazil	Genotoxicity Activity	Pollen	Agar Plate	10.0 mg	Active	<i>Escherichia coli</i> wp2s(lambda).	K29976
Leaf Brazil	Mutagenic Activity	Lyophilized Extract	Agar Plate	10.0 mg	Equivocal	<i>Salmonella typhimurium</i> ta100.	L14998
Leaf Brazil	Mutagenic Activity	Lyophilized Extract	Agar Plate	10.0 mg	Equivocal	<i>Salmonella typhimurium</i> ta102.	L14998
Leaf Brazil	Mutagenic Activity	Pollen	Agar Plate	20.0 mg	Active	<i>Salmonella typhimurium</i> ta100.	K29976
Leaf Brazil	Mutagenic Activity	Pollen	Agar Plate	30.0 mg	Active	<i>Salmonella typhimurium</i> ta102.	K29976
Leaf Brazil	Mutagenic Activity	Pollen	Agar Plate	30.0 mg	Active	<i>Salmonella typhimurium</i> ta97.	K29976
Leaf Brazil	Mutagenic Activity	Pollen	Agar Plate	50.0 mg	Active	<i>Salmonella typhimurium</i> ta98.	K29976
Leaf Not Stated	Monamine Oxidase Inhibition	H2O-ETOH Ext	Not stated	10 mg/ml	Active	Inhibited MAO activity by 40-50%; effective in inhibiting both MAO A and MAO B.	AB1022
Leaf Paraguay	Thermogenic Activity	Leaves	Oral Human	IC100 .5 gm	Inactive Active	Non-obese women and men. No significant increase in energy expenditure noted after treatment. Drop in respiratory quotient observed, indicating a rise in the proportion of fat oxidized.	L05756
Not Stated	Thermogenic Activity	Not Stated	Oral Human	Not stated	Inactive		T15449

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Leaf Denmark	Thermogenic Activity	Not stated	Oral Human	Not stated	Active	In combination with Guarana and Damiana it prolonged gastric emptying time, reduced body weight and maintained weight over 12 months.	AB1010
Leaf Not Stated	Appetite Suppressant	Toothpaste	Not stated	1-2%	Active	In combination with other plants; a patent on a novel appetite suppressant toothpaste.	AB1023
Leaf Argentina	Lipid Peroxide Formation Inhibition	Infusion	Cell Culture	IC50=100.0 mcg/ml	Active	vs. H2O2-induced peroxidation	L07251
Leaf Argentina	Lipid Peroxide Formation Inhibition	Infusion	Cell Culture Microsomes-rat-liver	IC50=18.0 mcg/ml	Active	vs. CL4C/NADPH-induced lipid peroxidation.	L07251
Leaf Argentina	Lipid Peroxide Formation Inhibition	Infusion	Cell Culture Microsomes-rat-liver	IC50 28.0 mcg/ml	Active	vs. nonenzymatic lipid peroxidation stimulated by Fe2+/a scorbate.	L07251
Leaf Not stated	LDL Oxidative Modification Inhibition	H2O Ext	Not stated	37.5 mcg/ml	Active	vs. hydrogen peroxide induced LDL oxidation.	K18723
Leaf Not stated	LDL Oxidative Modification Inhibition	H2O Ext	Not stated	MIC=7.5 mcg/ml	Active	vs. cuso4 induced LDL oxidation. Inhibition is complete at 37.5 mcg/ml.	K18723
Leaf Argentina	Antioxidant Activity	H2O Ext	Not stated	30%	Active	vs. liposome oxidation AAPH.	L11901
Leaf Argentina	Antioxidant Activity	Infusion	Not stated	100.0 mcg/ml	Inactive	vs. hydroxyl radical.	L07251
Leaf Argentina	Antioxidant Activity	Infusion	Not stated	IC50=13.0 mcg/ml	Active	vs. DPPH. Superoxide scavenging activity increase.	L07251
Leaf Not stated	Antioxidant Activity	Infusion	Oral Human	500.0 ml	Active	Inhibited LDL oxidation in blood plasma. Whole plasma subjected to copper-induced oxidation.	K29485
Leaf Canada	Antioxidant Activity	H2O Ext	Oral Human	500.0 ml	Active	vs. Cu-induced LDL autoxidation.	J16235
Leaf Argentina	Antioxidant Activity	Infusion	<i>In vitro</i>	Not stated	Active	Inhibition of TRAP, TBARS and protection of Jurkat cells from AMVN-induced oxidation.	AB1009
Leaf Argentina	Radical Scavenging Effect	H2O Ext	Not stated	5%	Active	vs. TBARS.	L11901

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf USA	Antiglycation Activity	Not stated	<i>In vitro</i>	Not stated	Active	Inhibition of the action of the dicarbonyl; comparable to using millimolar concentrations of known AGE inhibitors aminoguanidine and carnosine.	AB1008
Leaf Paraguay	Lipoxygenase Inhibition	H2O Ext	Cell Culture	10.0 mcg/ml	Active	Cells-RBL-1	L11790
Leaf Paraguay	Lipoxygenase Inhibition	MEOH Ext	Cell Culture	10.0 mcg/ml	Active	Cells-RBL-1	L11790
Leaf Paraguay	Lipoxygenase Inhibition	Alkaloid Free H2O Extract	Cells-RBL-1	10.0 mcg/ml	Active	vs. epinephrine-induced hyperglycemia.	L11790
Leaf Paraguay	Lipoxygenase Inhibition	Benzene Ext	Cell Culture	10.0 mcg/ml	Inactive	Cells-RBL-1	L11790
Leaf Not stated	Anti-inflammatory Activity	MEOH Ext	External Mouse	2.0 mg	Active	Inhibition ratio=69%. vs. 12-o-tetradecanoylphorbol-13-acet-ate (TPA)-induced ear inflammation.	K11173
Leaf Not stated	Antibacterial Activity	ETOH(95%) Ext	Agar Plate	Not stated	Inactive	<i>Escherichia coli</i>	A15179
Leaf Not stated	Antibacterial Activity	ETOH(95%) Ext	Agar Plate	Not stated	Inactive	<i>Staphylococcus aureus</i>	A15179
Leaf Not stated	Antibacterial Activity	H2O Ext	Agar Plate	Not stated	Inactive	<i>Escherichia coli</i>	A15179
Leaf Not stated	Antibacterial Activity	H2O Ext	Agar Plate	Not stated	Inactive	<i>Staphylococcus aureus</i>	A15179
Leaf Not stated	Antimycobacterial Activity	ETOH(95%) Ext	Agar Plate	Not stated	Inactive	<i>Mycobacterium tuberculosis</i>	A15179
Leaf Not stated	Antimycobacterial Activity	H2O Ext	Agar Plate	Not stated	Inactive	<i>Mycobacterium tuberculosis</i>	A15179
Leaf Not stated	Antiviral Activity	H2O Ext	Cell Culture	10.0%	Inactive	<i>Virus-herpes type 2.</i>	T09507
Leaf Not stated	Antiviral Activity	H2O Ext	Cell Culture	10.0%	Inactive	<i>Virus-influenza 2 (manheim 57).</i>	T09507
Leaf Not stated	Antiviral Activity	H2O Ext	Cell Culture	10.0%	Inactive	<i>Virus-poliovirus.</i>	T09507
Leaf Not stated	Antiviral Activity	H2O Ext	Cell Culture	10.0%	Inactive	<i>Virus-vaccinia.</i>	T09507
Not stated Japan	Smooth Muscle Relaxant Activity	Butanol Ext	Guinea Pig Atrium	3.0 mcg/ml	Equivocal	vs. KCl-induced contractions.	J19977
Not stated Japan	Smooth Muscle Relaxant Activity	Butanol Ext	Rabbit Aorta	3.0 mcg/ml	Equivocal	vs. KCl-induced contractions.	J19977

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Japan	Smooth Muscle Relaxant Activity	Butanol Ext	Rabbit Aorta	3.0 mcg/ml	Equivocal	vs. norepinephrine-induced contractions	J19977
Leaf Japan	Smooth Muscle Relaxant Activity	ETOAC Ext	Guinea Pig Atrium	3.0 mcg/ml	Equivocal	vs. KCl-induced contractions.	J19977
Leaf Japan	Smooth Muscle Relaxant Activity	ETOAC Ext	Rabbit Aorta	3.0 mcg/ml	Active	vs. KCl-induced contractions. vs. norepinephrine-induced contractions.	J19977
Leaf Japan	Smooth Muscle Relaxant Activity	H2O Ext	Guinea Pig Atrium	3.0 mcg/ml	Equivocal	vs. KCl-induced contractions.	J19977
Leaf Japan	Smooth Muscle Relaxant Activity	H2O Ext	Rabbit Aorta	3.0 mcg/ml	Equivocal	vs. KCl-induced contractions. vs. norepinephrine-induced contractions.	J19977
Leaf Brazil	Vasoconstriction Inhibition	H2O Ext	Organ Culture	600.0 mcg/ml	Active	vs. methoxamine-induced contractions in mesenteric arterial bed.	L05460
Leaf Not stated	Cytotoxic Activity	H2O Ext	Cell Culture	10.0%	Active	HeLa cells.	T09507
Leaf Not stated	Antitumor Activity	H2O Ext	IP Mouse	Not stated	Active	Ca-755.	K18283
Leaf Uruguay	Anticrustacean Activity	Hot H2O Ext	Not stated	1.0%	Inactive	<i>Artemia salina</i> (Assay system is intended to predict for antitumor activity.)	K18125
Leaf Argentina	Cholagogue Activity	Decoction	Not stated	Not stated	Active	Increased bile flow and enhanced intestinal transit.	AB1011
Leaf Brazil	Hyaluronidase Inhibition	Hot H2O Ext	Not stated	0.01%	Weak Activity	60% inhibition.	A00401
Leaf Uruguay	Plant Root Growth Inhibition	Hot H2O Ext	Not stated	5.0%	Active	Assayed in <i>Triticum aestivum</i> .	K18125
Leaf Uruguay	Plant Root Growth Stimulant	Hot H2O Ext	Not stated	0.5%	Active	Assayed in <i>Triticum aestivum</i> .	K18125
Leaf Not stated	Cosmetic Effect	Resin	Not stated	0.2-10 g	Active	Produces a stable protective film on the skin. Intensifies color, increases luster, contributes to good wet compatibility and improves the elasticity of the hair.	AB1021

Biological Activities for Compounds of Yerba maté (*Ilex paraguariensis*)

(Please note: The following is just a representation of some of the published research on compounds in yerba maté.)

Compound Tested	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Caffeine	Toxicity (in utero)	Oral Rat	0.02% drinking water	Active	In utero exposure affects central respiratory control - higher respiratory frequency and hypoxic respiratory depression seen.	AB1030
Theophylline	Mutagenic Activity	Not stated	Not stated	Inactive	<i>Salmonella typhimurium</i> .	AB1046
Caffeine	Stimulant	Not stated	Not stated	Active	Stimulates the central nervous system; increases the activity of the heart.	AB1004
Caffeine	Athletic Performance Activity	Oral Human Adult	250 mg	Inactive Active Active	Short-term performance. Blood lactate increased. Plasma insulin concentrations at rest, end of mock test and during recovery were increased.	AB1035
Caffeine	Cognitive Performance	Oral Human Adult	200 mg 300 mg	Active Active	Subjects received caffeine after 72 hrs of sleep deprivation and continuous exposure to stressors. Caffeine improved visual vigilance, choice reaction time, repeated acquisition, self-reported fatigue and sleepiness. Improved results on tests of vigilance, reaction time and alertness.	AB1036
Caffeine	Cognitive Performance	Oral Human Adult	1 or 2 mg/kg followed 60 minutes later with 1 mg/kg	Active Inactive	Improved performance on a sustained attention task and increased mental alertness in caffeine-deprived consumers. No effect on rated mental alertness and performance on an attention task in consumers who were not caffeine deprived.	AB1037
Caffeine	Cognitive Performance	IP Rat	0.3-10 mg/kg 30 mg/kg 0.3-30 mg/kg	Active Inactive Active	Post-training dose improved memory retention. Post-training memory retention. Pre-test dose increased memory retrieval.	AB1038
Caffeine	Cognitive Performance	Oral Human Adult	200 mg	Active	Increased alertness and anxiety and improved performance on simple and choice reactive tasks, a cognitive vigilance task, a task requiring sustained response and a dual task involving tracking and target detection.	AB1039

Compound Tested	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Caffeic acid	Antidepressant Activity	IP Mice	10 x (-9) - 10 x (-3) M	Active	Mechanism by some other inhibition of monoamine transporters and monoamine oxidase.	AB1027
Theobromine	Diuretic	Not stated	Not stated	Active		AB1004
Caffeine	Diuretic	Not stated	Not stated	Active		AB1004
Theophylline	Diuretic	Not stated	Not stated	Active		AB1004
Theobromine	Antispasmodic Activity	Not stated	Not stated	Active	Smooth muscle.	AB1004
Theophylline	Antispasmodic Activity	Not stated	Not stated	Active	Smooth muscle	AB1004
Theophylline	Antispasmodic Activity	Not stated	Not stated	Active	Relaxed the smooth muscles of the bronchi and blood vessels.	AB1046
Caffeic acid	Motor Activity	IP Mice	4 mg/kg	Active	Reduced the duration of immobility in the forced swimming test.	AB1027
Theophylline	Bronchodilator Activity	Not stated	Not stated	Active	Used for conditions such as obstructive airway disease and bronchial asthma.	AB1046
Theophylline	Respiratory Activity	Not stated	Not stated	Active	Modest effect on FEV1 and FVC and slightly improved arterial blood gas tensions in COPD.	AB1047
Alpha-amyrin	Anti-inflammatory Activity	Rat	Not stated	Inactive	No effect on the prostaglandin phase of carrageenin pedal edema in rats.	AB1024
Beta-amyrin	Anti-inflammatory Activity	<i>In vitro</i>	Not stated	Active Inactive	Reduced 5-HETE synthesis. LTB4 synthesis.	AB1025
Caffeic acid	Anti-inflammatory Activity	Cell Culture (human monocytes)	Not stated	Active	Inhibited LPS-induced TNF-alpha release at a low dose.	AB1026
Caffeine	Anti-inflammatory Activity	Cell Culture	5 x 10(-6) - 1.5 x 10(-4) mol/l	Inactive	No significant effect on endotoxin-induced PGE(2) formation nor on its inhibition by indometacin.	AB1029
Ursolic acid	Anti-inflammatory Activity	Mice	ID50=0.14 microMoles/cm2	Active	Vs. croton oil-induced ear edema. Two-fold more potent than indomethacin.	AB1053
Alpha-amyrin	Anti-arthritis Activity	Not stated	Not stated	Active	Local inhibition of joint destruction.	AB1024
Alpha-amyrin	Cytotoxic Activity	Cell Culture	IC50=14 microM	Active	Rat osteosarcoma cell.	AB1024

GI = Gastric Intubation IG = Intra-gastric IP = Intraperitoneally IV = Intravenously SC = Subcutaneously IM = Intramuscular
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Compound Tested	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Caffeine	Cytotoxic Activity	Topical Mice	Not stated	Active	Inhibited carcinogenesis and stimulated apoptosis of skin tumors. Decreased size of parametrial fat pads and the thickness of the dermal fat layer.	AB1028
Chlorogenic acid	Cytotoxic Activity	Cell Culture	Not stated	Active Active	Human oral squamous cell carcinoma (HSC-2). Salivary gland tumor (HSG).	AB1041
Geraniol	Cytotoxic Activity	Cell Culture	400 microM	Active	Sensitized colon cancer cells to 5-FU treatment, increasing the antiproliferative and cytotoxic activity of the drug.	AB1044
Ursolic acid	Cytotoxic Activity	Cell Culture	IC50=8.26 mumol/L 10-50 mumol/L	Active Active	HL-60 cells. Apoptosis of HL-60 cells induced.	AB1050
Ursolic acid	Antitumor Activity	Cell Culture	Not stated	Active	Increased nitric oxide and TNF-alpha production.	AB1051
Ursolic acid	Antitumor Activity	Cell Culture	Not stated	Active	Induced apoptosis and interfered with enzymes involved in DNA synthesis. Prevented malignant transformation of normal cells.	AB1052
Geraniol	Antiproliferative Activity	Cell Culture	400 microM	Active Active	70% inhibition of human colon cancer cell line (Caco-2). 50% decrease of ornithine decarboxylase activity.	AB1045
Caffeine	Cardiovascular Activity	Oral Human Adult (hypertensive)	250 mg	Active	Systolic blood pressure and pulse pressure increased; no change in diastolic blood pressure; an increase in aortic stiffness seen.	AB1031
Caffeine	Cardiovascular Activity	Oral Human Adult	870 mg	Active	Increased fasting homocysteine by 0.4 micromol/L or 5%. Effect was stronger in women.	AB1034
Theophylline	Cardiovascular Activity	Not stated	Not stated	Active	Used for myocardial stimulation.	AB1046
Chlorogenic acid	Hypocholesterolemic Activity	IV Rat	5 mg/kg	Active	Decreased fasting plasma cholesterol (44%), triacylglycerols (58%) and liver triacylglycerols concentrations (24%).	AB1040
Caffeine	Osteoporotic Activity	Oral Human Adult Female	200-300 mg (2.5-6 fl oz cups)	Active	Associated with a loss of bone mineral density in most skeletal sites. Attenuated with a higher calcium intake (750 mg/day).	AB1032

Compound Tested	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Chlorogenic acid	Hypoglycemic Activity	IV Rat	5 mg/kg	Inactive Active	Did not promote sustained hypoglycemia. Lowered postprandial peak response to glucose challenge.	AB1040
Eugenol	Antiestrogenic Activity	<i>In vitro</i>	Not stated	Active		AB1042
Geraniol	Estrogenic Activity	<i>In vitro</i> Mice	Not stated Not stated	Active Inactive		AB1042
Eugenol	Antibacterial Activity	Agar Plate	BA50=0.003-0.034 BA50=0.019-0.43 BA50=0.034-0.21	Active Active Active	<i>C. jejuni</i> <i>L. monocytogenes</i> <i>S. enterica</i>	AB1043
Geraniol	Antibacterial Activity	Agar Plate	BA50=0.057-0.28 BA50=0.019-0.43 BA50=0.034-0.21	Active Active Active	<i>E. coli</i> <i>L. monocytogenes</i> <i>S. enterica</i>	AB1043
Ursolic acid	Antitrypanocidal Activity	<i>In vitro</i>	MC100=40 micro g/ml	Active	<i>T. cruzi</i>	AB1049
Saponin Fraction	Complex Formation	Not stated	21 gm/L	Active	Reduced passive diffusion of cholic acid through cellulose membrane.	K28925
Caffeine	Adenosine Antagonist	Oral Human Adult Male	6 mg/kg	Active	Antagonist to adenosine resulting in an increase in noradrenaline and serotonin which is excitatory to spinal motor neurons, increasing the occurrence of self-sustained firing.	AB1033
Caffeine	Adenosine Antagonist	Not stated	Not stated	Active		AB1038
Theophylline	Adenosine Antagonist	Not stated	Not stated	Active	May ameliorate chest pain in those with hypersensitive esophagus by altering adenosine-mediated nociception.	AB1048

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GI = Gastric Intubation IG = Intragastric IP = Intraperitoneally IV = Intravenously SC = Subcutaneously IM = Intramuscular
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