

Supplementary Data

Table S1

Summary of the major biological activities and mechanism of action of different parts, extracts as well as compounds obtained from green tea (*Camellia sinensis*)

Activity	Effect	Part Used/Compound/Formulation/Method of consumption or usage	References
Antioxidant & Hepatoprotective	↑ Free radical scavenging ↓ Lowered GSH ↑ Carcinogens excretion	Green tea polyphenols	(1), (2), (3), (4), (5), (6)
	↑ Phase II enzymes	Aqueous extract	(7)
	↓ Oil oxidation	Dechlorophyllized extract	(8)
	↓ Oxidative stress	Green tea extract ice cream (Polypenol)	(9)
	↑ Physical performance		(10)
	↑ Salivary antioxidants	Consumption (Smokers)	
	↓ Cell death	EGCG & (-)-Epigallocatechin-3-(3"-O-methyl) gallate	(11)
	↓ Free radicals produced during metabolism of xenobiotics in the liver	Consumption	(12)
	↓ Fat storage in the liver	Short-time decoction (Chronic usage)	(13)
	↓ Elevated serum ALT, AST, hepatic protein carbonyls & ROS	Leaves	(14)
↓ Inflammation & hepatic mitochondrial DNA damage	Extract	(15), (16)	
↓ Cisplatin-induced intestinal and hepatic toxicity	Consumption	(17)	

Anti-Cancer & Anti-Mutagenic	↑ NK cell activity	Flavonoids	(18)
	↑ Apoptosis & tumor suppression ↓ Sister-chromatid exchange	Polyphenols	(19), (20), (21)
	↓ Angiogenesis ↓ MMPs	Catechins	(22), (23), (24) (25), (26)
	↑ Gap junctional intercellular communication ↓ FAS activity ↓ VEGF Family	EGCG & its auto-oxidation products	(27)
	↑ cAMP	Methyl xanthines	(28)
	↑ Macrophages and NK cells activity	Polysaccharides	(29), (30), (31), (32), (33), (34), (35), (36).
	↑ Metabolism & Excretion of carcinogens	Aqueous extract	(37), (38), (39).
	↑ Fidelity of DNA replication ↓ TNF- α gene expression	EGCG	(21).
	↓ Microsomal aryl hydrocarbon hydroxylase activity	(+)catechin, EC, EGC, ECG & EGCG	(34).
	Antigenotoxic activity	Pheophytins a and b	(40).
	Late onset of cancer & ↓ RR of its incidence	Increased consumption	(41).
	Chemopreventive agent	↑ EGCG:Caffeine	(42).
	↓ O ₂ ⁻ & NO production	Catechin	
	↑ UDP-glucuronosyltransferase induction		

	↑ Toxin metabolism	Consumption	(43)
	↑ P-glycoprotein-mediated efflux function	Catechin, EC, ECG, gallicocatechin, EGC & EGCG	(44)
		EC	(45)
Skin	Anti-tumor promotion	EGCG	(46)
	↓ Tumorigenicity	Tannic acid & GTPs	(47)
	↓ Induced inflammatory Rx	Pheophytin a and b	(48)
	↓ Skin lesions & redness	Oral consumption	(49), (50)
	↓ Epidermal microsomes lipid peroxidation	EGCG>ECG>EGC>EC	(51)
	↓ Photocarcinogenesis	EGCG	(52)
	↓ Tyrosinase activity	ECG, GCG & EGCG	(53)
Foreestomach	Interaction & ↓ metabolism of carcinogen ↓ Metastasis	GTPs	(53), (54), (55)
Duodenum	↓ Duodenal cancer	EGCG	(56)
Colon	↓ Promotion stage	GTPs	(57)
	↓ Incidence & number ↓ Colonic mucosa DNA damage ↓ Metachronous adenomas incidence	Extract	(58), (59), (60), (61)
	↓ LOX- & COX- dependent arachidonic acid metabolism		(62)
	↓ Colorectal carcinoma cells	ECG> EGCG & EGC	
	↓ Topoisomerase I activity		(63)

	& ↓ Intermediate & late stages	EGC & EGCG < EC	
		EGCG	(64), (65)
Lung	<p>↓ Mortality</p> <p>↓ Mean number & ↓ multiplicity of adenomas</p> <p>↑ Superoxide radicals scavenging</p> <p>↓ Lung cancer stem cells</p> <p>↑ Apoptosis</p> <p>↓ Penetration of cancerous cells through the basement membrane</p> <p>↓ Cells DNA strand breaks</p> <p>↑ Apoptosis</p> <p>↓ Invasion of highly metastatic cancerous cells</p>	<p>Consumption</p> <p>EGCG</p> <p>Infusion & Catechins</p> <p>GTPs</p> <p>EGCG & EC</p> <p>ECG</p>	<p>(66).</p> <p>(67), (68), (69), (70).</p> <p>(71).</p> <p>(72).</p> <p>(73).</p> <p>(74).</p>
Leukemia	<p>↓ Sister-chromatid exchanges</p> <p>↓ Growth factors' signaling, ↓ differentiation, ↑ proliferation & ↑ B-cell and T-cell chronic lymphocytic leukemia apoptosis</p> <p>↓ Acute Myeloid Leukemia</p>	<p>Crude catechin</p> <p>EGCG</p> <p>Consumption</p>	<p>(75).</p> <p>(76), (77), (78).</p> <p>(79).</p>
Breast	<p>↓ Mortality, ↓ average sizes of tumors & ↓ post-initiation stage</p> <p>↓ Early promotion stage</p> <p>↓ Stages I and II recurrence rate</p>	<p>Catechins</p> <p>Polyphenon E (58.4% EGCG)</p>	<p>(80).</p> <p>(81), (82).</p>

	<p>↓ Early stage recurrence</p> <p>↓ PSA production</p> <p>↓ Ornithine decarboxylase</p> <p>↓ Cell growth & ↑ cell death</p> <p>↓ Cell cycle progression</p> <p>↓ Size & number of tumors</p> <p>↓ Human breast cancer</p>	<p>High daily consumption</p> <p>Regular consumption</p> <p>Flavonoids</p> <p>GTPs</p> <p>Extract</p> <p>EGCG</p> <p>Selenium-enriched GTP</p>	<p>(73).</p> <p>(83).</p> <p>(84).</p> <p>(84).</p> <p>(85).</p> <p>(86), (87).</p> <p>(88).</p>
Large intestine	<p>↓ Number & size of cancers</p> <p>↓ Iκ-B kinase complex activity</p>	<p>GTPs</p> <p>EGCG</p>	<p>(3).</p> <p>(89).</p>
Liver	<p>↓ Oxygen free radical-generated cell death</p> <p>↓ inhibition of gap junctional intercellular communication</p> <p>↓ DNA damage & ↓ cell proliferation</p> <p>↓ Hepatotoxicity</p> <p>↓ Tumor number</p> <p>↓ NOS activity</p> <p>↓ Hepatocellular carcinoma cells cancer growth</p>	<p>Catechins</p> <p>Crude catechin</p> <p>Decaffeinated intake</p> <p>Polyphenols</p> <p>EGC & EGCG >EC</p>	<p>(90).</p> <p>(91).</p> <p>(67).</p> <p>(92).</p> <p>(63).</p>
Ascites	<p>↓ Doxorubicin efflux</p>	<p>Theanine</p>	<p>(93).</p>

	↓ Tumor cells viability	EGC & Extract	(94), (95).
Prostate	↓ Cancer cell growth & ↑ Apoptosis ↑ Cancer-free cases ↓ PSA production ↓ Cell growth & ↑ Apoptosis ↓ Advanced prostate cancers risk	EGCG GTP oral infusion (6 cups/day) Flavonoids Extract & ECG > EGCG > EGC Intake	(96), (97), (98), (99). (100). (84). (101). (102).
Ovary	↓ Adriamycin efflux ↓ Risk	Theanine Consumption	(103). (104).
Bladder	↓ Cell proliferation & viability, ↑ apoptosis & ↓ cancer cells migration & tumor growth	EGCG	(105), (106).
Brain	↓ Glioblastoma cells ↓ inflammatory processes	Catechins gallate & EGCG EGCG	(107). (108), (109).
Kidney	↓ Growth	Intake, Extract & EGCG	(110), (111).
Cervix	↑ Apoptosis	EGCG > Polyphenol E	(112).
Head & Neck	↓ Progression	EGCG	(113).
Papillomavirus-induced neoplasia	↓ Neoplasia	EGCG	(114).
Antimicrobial	↑ Bacterial membranes damage & ↑ morphological distortions of <i>Candida</i> ↓ Extracellular vero toxins	Catechins	(115), (116).

	<p>production and release</p> <p>↓ <i>Salmonella typhimurium</i> type III activity & invasion, ↓ ricin toxin, ↓ Brazilian strain of Zika virus entry & ↓ efflux pumps of carbapenem</p> <p>Antiseptic, ↓ several pathogenic bacteria activity, ↓ bacterial spores development & growth, ↓ bacteriophages</p> <p>Bactericidal against G+ve, Bacteriostatic against G-ve, less anti-fungal, ↓ Dental caries bacteria, ↓ facultative anaerobes, ↓ obligative anaerobes</p> <p>↓ 1-Deoxy-D-xylulose 5-phosphate reductoisomerase activity</p> <p>↑ Apoptotic markers</p> <p>↓ Multidrug resistant bacterial strain activity</p> <p>↓ HIV sexual transmission</p> <p>↓ HIV-1 Infectivity</p>	<p>EGCG & GCG</p> <p>EGCG</p> <p>Polyphenols</p> <p>Extract</p> <p>Raw extract (GCG)</p> <p>Chlorogenic acid</p> <p>GA & Polyphenols</p> <p>EGCG (Topical)</p> <p>Polyphenon E (EGCG drug formulation)</p>	<p>(117).</p> <p>(118), (119), (120), (121).</p> <p>(1), (122), (123).</p> <p>(124), (125), (126).</p> <p>(127).</p> <p>(128).</p> <p>(129).</p> <p>(130).</p> <p>(131).</p>
Anti-Schistosomiasis & Anti-Parasitic	<p>↑ Hepatocytes improvement, ↓ cellular necrosis & ↑ total protein & glycogen levels Anti-parasitic activity</p>	<p>Aqueous extract</p>	<p>(132), (133).</p>

Cardioprotective	<p>↓ Risk factors for heart disease</p> <p>↓ Coronary heart disease development</p> <p>↑ Vascular function</p> <p>↓ CV risk factor</p> <p>↓ Myocardial fibrotic degeneration</p> <p>↓ CV diseases risk & ↓ Coronary atherosclerosis</p> <p>↓ MI</p> <p>↓ CAD risk</p> <p>↓ Cardiac injury following ischemia ↑ Coronary flow velocity reserve</p> <p>Adjunct therapy of CV disease</p> <p>↓ Doxorubicin-induced modifications in cardiomyocyte fatty acid composition ↑ Excretion & ↓ Absorption of cholesterol ↓ Superoxide anion generation & ↓ High BP</p> <p>↓ Doxorubicin-induced cardiotoxicity, ↓ arsenic-induced cardiotoxicity, ↓ inflammation & mortality rate</p> <p>↓ Cardiac arrhythmia, ↑ fasting plasma insulin, ↑ insulin resistance</p>	<p>Consumption</p> <p>Non-fermented Beverage & Catechin-rich fractions</p> <p>High pressure process prepared</p> <p><i>O</i>-methylated catechin</p> <p>Catechins</p> <p>Consumption (7-8 cups /day)</p> <p>Consumption (>1 cup/ day)</p> <p>Highest consumption</p> <p>High dietary intake</p> <p>Flavonoids</p> <p>Polyphenols</p> <p>Extract</p>	<p>(134).</p> <p>(135).</p> <p>(136).</p> <p>(137).</p> <p>(138).</p> <p>(139), (140), (141).</p> <p>(142).</p> <p>(143), (144).</p> <p>(145).</p> <p>(146).</p> <p>(147).</p> <p>(148), (149), (150).</p> <p>(151), (152), (153).</p>

↓ LDL oxidation	EGCG	
↓ Biosynthesis		(154), (155)
↓ LDL lipid peroxidation	EC	
↓ Biogenesis		(156)
↓ Free radicals-induced LDL peroxidation	Consumption	(157)
↑ α-tocopherol regeneration	Processed & Unprocessed extract	(158)
↓ Endothelial cell-induced LDL oxidation	Polyphenols > Caffeine	(159)
↑ LDL resistance to <i>in vivo</i> oxidation	EGCG, GCG & ECG	(160)
↓ LDL	EC>EGCG>ECG>EGC> GA	(160)
↑ LDL oxidation lag time	ECG, EC, EGCG, EGC & GA	(135)
↓ Serum TGs	Catechin-rich fractions	(139)
↓ Fat storage in the liver & ↓ blood lipids and ↑ TGs fecal excretion	Daily consumption of 7-8 cups	(161)
↓ Dyslipidemia	Daily consumption of ≥ 10 cups	(162)
↓ High BP	Flavonoids	(163)
↓ Dopa decarboxylase enzyme	Floratheasaponins A-C (Flowers>Seeds)	(13)
↓ ROS	Short-time decoction (Chronic usage)	
↓ ROS formation	<i>O</i> -methylated catechin	(137)
↓ Thromboxane-B2	Fresh leaves fermented under N2 gas & Theanine	(164)

	<p>↓ Thrombosis</p> <p>↓ Sickle cells dehydration & ↑ Dense cells formation</p>	<p>EGCG & EGC</p> <p>Chronic infusion of EGCG in PVN</p> <p>Decaffeinated extract</p> <p>Unprocessed extracts</p> <p>Catechins & EGCG</p> <p>Extracts (↑ OHs group)</p>	<p>(165).</p> <p>(166).</p> <p>(167).</p> <p>(168).</p> <p>(157).</p> <p>(169).</p> <p>(170).</p>
<p>Anti-Diabetic & Anti-Obesity</p>	<p>↑ Glucose tolerance, ↓ elevated serum glucose level, ↓ elevated hepatic and renal enzymes, ↓ elevated serum lipid peroxidation levels, ↑ decreased liver glycogen, ↑ GSH levels & ↓ endothelial autophagy inhibition “Exercise mimetic” prosperities ↓ Body weight</p> <p>↓ Endothelial cell growth, ↓ diabetes complications & ↑ insulin-resistant muscle resensitization ↑ Lipolysis, ↓ FAS activity, ↑ energy expenditure & ↑ metabolic rate ↓ Serum glucose elevation</p> <p>↓ α-amylase activity</p> <p>↓ pancreatic α-amylase activity</p> <p>↑ Glucose and lipids metabolism & ↓ insulin consumption</p> <p>↓ Fasting glucose in elderly</p>	<p>GTPs</p> <p>EGCG</p> <p>Floratheasaponins A, B, and C</p> <p>H2O-soluble polysaccharide fraction</p>	<p>(171), (172), (173), (57).</p> <p>(174), (175), (176), (177), (178), (26), (179).</p> <p>(180).</p> <p>(181).</p>

↓ Waist circumferences	Catechin (Galloyl moiety)	(182).
↓ Hyperglycemia		
↓ Fluid consumption, ↓ body weight & ↓ waist circumference	Consumption	(183).
↓ Fat storage in the liver & ↓ glucose	Green tea-Vit. E (Daily)	(184).
↑ Fasting plasma insulin & ↓ insulin resistance	Extract	(185), (186), (187).
↓ Fat digestion		(13).
↑ Thermogenesis, ↑ fat oxidation & ↓ Adipogenesis	Short-time decoction (Chronic usage)	
↓ Obesity		(155).
↓ Weight gain	EC	
↓ Average body weight	Saponins	(188).
↑ Energy expenditure, & ↑ fat oxidation	EGCG & Caffeine	(189), (173).
↓ Weight gain	High pressure process prepared	(136).
↓ Weight & body mass index	Caffeine	(190).
	Catechol & TA	(80).
	Catechins & Caffeine	(191).
		(13).
	Short-time decoction (Chronic usage) & EGCG	(192).
	Consumption (with training)	

<p>Gastrointestinal Tract Problems Relieving</p>	<p>↑ Mesenteric arteries relaxation</p> <p>↑ Elastin content regeneration, ↓ inflammation & ↓ abdominal aortic aneurysm</p> <p>↓ Precancerous chronic atrophic gastritis</p> <p>↓ Gastric mucosal lesions</p> <p>↓ <i>Clostridium difficile</i> ↓ <i>Clostridium perfringens</i></p> <p>Faecal microbiome & endogenous metabolites modulation</p>	<p>EC</p> <p>EGCG</p> <p>High consumption</p> <p>Floratheasaponins A, B, and C</p> <p>Vitamin C Polyphenols</p> <p>Consumption</p>	<p>(193).</p> <p>(194).</p> <p>(195).</p> <p>(180).</p> <p>(196).</p> <p>(197).</p>
<p>Neuroprotective</p>	<p>↓ Lipid peroxidation damage</p> <p>↓ Stress-induced neural injuries ↓ Ischemic neuronal damage & ↓ Increase of nitric oxide radical concentrations in the intact hippocampus</p> <p>↑ Angiogenesis</p> <p>↓ TH-positive cells loss, ↓ nNOS expression, ↓ neuronal apoptosis & ↑ growth and survival of astrocytes regulation</p> <p>↑ Spatial memory function in mice induced-dementia</p> <p>↓ Ischemia/reperfusion-induced brain injury</p> <p>↓ Age-related deficits, ↓ cognitive decline, ↓ stroke-induced short & long term declarative memory</p>	<p>EGCG, ECG, EGC & EC</p> <p>EGCG</p> <p>Extract</p>	<p>(198).</p> <p>(199), (200), (201), (202), (203), (204), (205), (206), (207).</p> <p>(208), (209), (210), (211), (212).</p>

	<p>Stroke onset prevention</p> <p>↓ Stroke risk</p> <p>↓ Neurotoxicity ↑ Memory & ↑ learning ability Affecting Emotions ↑ Relaxation</p> <p>Neuroprotective</p> <p>↓ Morphologic & functional changes in accelerated senile brains & ↓ β-secretase activity</p> <p>↓ Dopa decarboxylase activity</p> <p>↓ Amyloid-β aggregates</p> <p>↑ Learning ability</p> <p>Neuronal activity modulator</p> <p>Synaptic transmission modulator</p> <p>↓ Adrenal hypertrophy (Caffeine & EGCG)</p>	<p>Consumption (3 cups/ day)</p> <p>Consumption (>3 cups/ day)</p> <p>L-theanine</p> <p>Polyphenols</p> <p>Catechin</p> <p>EGCG & EGC</p> <p>EC</p> <p>EGC & GA ingestion > EGCG</p> <p>Polyphenols (EGCG)</p> <p>Consumption</p> <p>Theanine (low caffeine), EGC & arginine</p>	<p>(213).</p> <p>(140), (161).</p> <p>(214), (165).</p> <p>(215), (216).</p> <p>(217), (218).</p> <p>(166).</p> <p>(219).</p> <p>(220).</p> <p>(221).</p> <p>(222).</p> <p>(223).</p>
<p>Anti-Inflammatory, Analgesic, Anti-Pyretic & Anti-Allergic</p>	<p>↓ Inflammatory diseases</p> <p>↓ NO production & ↓ Angiogenesis</p> <p>↓ PMNs activation</p> <p>Anti-pyretic & Diuretic</p> <p>↓ Pain</p>	<p>Consumption</p> <p>EGCG</p> <p>Pheophytin a and b</p> <p>Consumption</p> <p>Extract & Tablets</p>	<p>(224), (225).</p> <p>(226), (174).</p> <p>(48).</p> <p>(227).</p> <p>(228), (229), (230).</p>

	<p>↓ Histamine release</p> <p>↓ Allergy</p> <p>↓ Histamine & IgE production</p> <p>↑ Heat-generating mechanisms</p>	<p>Polyphenols</p> <p>Leaf Saponins & Floratheasaponins</p> <p>Methylated EGCG</p> <p>Consumption</p>	<p>(231).</p> <p>(232), (233).</p>
<p>Skeletomuscular System Relieving</p>	<p>↑ Skeletal muscles vasodilatation, ↑ muscle microvascular blood flow, ↑ myogenic differentiation & ↑ muscles mass & function recovery</p> <p>↑ Osteoclasts cell death, ↓ Inflammation, ↑ Bone regeneration, ↑ osteoprotegerin synthesis & ↓ osteoclastic bone resorption</p> <p>↓ NO production & lactate dehydrogenase release</p> <p>↓ Bone and hyaline cartilage alteration</p> <p>↓ inflammation & joint destruction</p> <p>↓ Pain & ↑ knee joint physical function</p>	<p>EGCG</p> <p>Consumption</p> <p>Consumption (EGCG)</p> <p>Extract & Tablets</p>	<p>(234), (235), (236), (237), (238), (239), (240).</p> <p>(39)</p> <p>(39).</p> <p>(229), (230).</p>

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