

Composition of green and roasted coffees (according to variety) and of instant coffee (expressed as a percentage of the dry basis)

Component	Arabica		Robusta		Instant
	Green	Roasted	Green	Roasted	
Minerals	3.0-4.2	3.5-4.5	4.0-4.5	4.6-5.0	9.0-10.0
Caffeine	0.9-1.2	Appr. 1.0	1.6-2.4	Appr. 2.0	4.5-5.1
Trigonelline	1.0-1.2	0.5-1.0	0.6-0.75	0.3-0.6	-
Lipids	12.0-18.0	14.5-20.0	9.0-13.0	11.0-16.0	1.5-1.6
Total Chlorogenic acids	5.5-8.0	1.2-2.3	7.0-10.0	3.9-4.6	5.2-7.4
Aliphatic acids	1.5-2.0	1.0-1.5	1.5-2.0	1.0-1.5	-
Oligosaccharides	6.0-8.0	0-3.5	5.0-7.0	0-3.5	0.7-5.2
Total polysaccharides	50.0-55.0	24.0-39.0	37.0-47.0	-	Appr 6.5
Amino acids	2.0	0	2.0	0	0
Proteins	11.0-13.0	13.0-15.0	11.0-13.0	13.0-15.0	16.0-21.0
Humic acids	-	16.0-17.0	-	16.0-17.0	15.0

Carbohydrate content in green coffee (% of dry basis)

Constituent	Arabica	Robusta
Monosaccharides	0.2-0.5	0.2-0.5
Sucrose	6-9	3-7
Polysaccharides	43.0-45.0	46.9-48.3
■ arabinose	3.4-4.0	3.8-4.1
■ mannose	21.3-22.5	21.7-22.4
■ glucose	6.7-7.8	7.8-8.7
■ galactose	10.4-11.9	12.4-14.0
■ rhamnose	0.3	0.3
■ xylose	0-0.2	0.2

Fatty acid composition of oil from green coffee beans, expressed as a % of total lipids

Authors	1	2	3	4	
Myristic a. C14:0	Traces	Traces	0.06-0.14	0.2	Palmitic acid
Palmitic a. C16:0	35.20-39.60	30.7-35.3	35.44-41.35	35.2-36.7	
Palmitoleic a. C16:1	Traces	Traces	-	-	Linoleic acid
Margaric a. C17:0	-	Traces	-	-	
Stearic a. C18:0	6.60-8.35	6.6-9.0	7.53-10.60	7.2-9.7	
Oleic a. C18:1	7.55-10.90	7.6-10.1	8.07-9.58	9.5-11.9	
Linoleic a. C18:2	38.40-43.0	43.2-45.9	36.64-43.08	41.2-42.6	
Linolenic a. C18:3	?	1.1-1.7	-	1.3-2.7	
Arachidic C20:0	4.05-4.75	2.7-3.3	X	0.3-1.5	
Gadoleic C20:1	-	?	X	-	
Behemic a. C22:0	0.65-2.60	0.3-0.5	X	-	

- 1) C20:0 and higher = 4.28-8.43
 2) Calorini (C.), Cerni (E.) Riv. Ital. Sostanze Grasse 1963; 40, 176-180
 3) Kropfen (U.) Green and Roasted Coffee Tests, Gordian Hamburg 1963
 4) Hartman (L.), Lago (R.C.A.), Tanga (I.S.), Touara (C.G.), J. Amer. Oil Chem Soc. 1966, 45, 577-579
 5) Chassevent (F.), Gerwig (S.), Vicent (J.C.) Café, Cacao, The, 1974, 19, 49-59

Lipid composition of green coffee (expressed as a % total lipids)

Lipidic Fractions	%	Components
Triglycerides	70-80	Esters of linoleic and palmitic acids
Free fatty acids (in % of oleic acid)	0.5-2.0	Esters of linoleic and palmitic acids Cafestol (furokaurane) and (in arabica) kahweol (furokaurene), atractyligenine, sitosterol, stigmasterol, campesterol
Esters of diterpenes	15-18.5	
Triterpenes, sterols, ester of methylsterols	1.4-3.2	
Free diterpenes	0.1-1.2	
Free triterpenes and sterols	1.3-2.2	Squalene and nonacosane
Phospholipids	0.1	Amides of arachidic, behenic and lignoceric acids
Hydrocarbons	Traces	
5-Hydroxytryptamides	0.3-1.0	Alpha, beta and gamma isomers
Tocopherols	0.3-0.7	

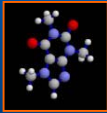
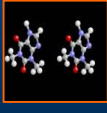
Free and total amino acids in green coffee (% of dry basis)

Amino acid	Free amino acids		Total Proteins	
	Arabica	Robusta		
Alanine	0.05	0.09	0.5	
Arginine	0.01	0.02	0.5	
Aspartic Acid	0.05	0.09	1.0	Aspartic acid
Asparagine	0.05	0.09		
Cysteine	0.001	0.001	0.3	
Glutamic Acid	0.13	0.08	1.9	Glutamic acid
Glycine	0.01	0.02	0.6	
Histidine	0.01	Traces	0.2	
3-methylhistidine	Traces	Traces		
Isoleucine	0.01	0.02	0.4	
Leucine	0.01	0.02	1.0	Leucine
Gamma-aminobutyric acid	0.05	0.10		
Lysine	0.01	Traces	0.6	
Methionine	0.004	0.004	0.2	
Phenylalanine	0.02	0.04	0.7	Phenylalanine
Proline	0.03	0.04	0.6	
Serine	0.03	0.04	0.5	
Threonine	Traces	0.01	0.3	
Tyrosine	0.01	0.02	0.4	
Valine	0.01	0.02	0.5	
Tryptophan	0.01	0.05	0.1	
TOTAL	0.5	0.8	10.3	

Amino acid composition (as a % total proteins) of green and roasted coffees after hydrolysis

Amino Acids	Arabica (Haiti)			Robusta (Angola)		
	Green bean	High roasting	Moderate roasting	Green bean	High roasting	Moderate roasting
Alanine	4.91	5.97	5.48	4.87	6.84	7.85
Arginine	4.72	0.00	0.00	2.28	0.00	0.00
Aspartic Acid	10.50	9.07	9.02	9.44	8.94	8.19
Cysteine	3.44	0.38	0.34	3.87	0.14	0.14
Glutamic acid	18.86	20.86	23.29	17.88	24.01	29.34
Glycine	5.99	6.86	7.08	6.26	7.68	8.87
Histidine	2.85	1.99	2.17	1.79	2.23	0.85
Isoleucine	4.42	4.75	4.91	4.11	5.03	5.46
Leucine	8.74	9.95	11.19	9.04	9.65	14.12
Lysine	6.19	2.54	2.74	5.36	2.23	2.56
Methionine	2.06	2.32	1.48	1.29	1.68	1.71
Phenylalanine	5.79	6.75	6.05	4.67	7.26	6.82
Proline	6.58	6.52	6.96	6.46	9.35	10.22
Serine	5.60	1.77	1.26	4.97	0.14	0.00
Threonine	3.73	2.43	1.83	3.48	2.37	1.02
Tyrosine	3.54	4.31	3.54	7.45	9.49	8.87
Valine	5.50	6.86	3.31	6.95	10.47	9.49

Purine alkaloids in green coffee expressed in mg/kg/db

Component	Arabica	Robusta	
Caffeine	9,000-14,000	15,000-26,000	 <p>Caffeine</p>
Theobromine	36-40	26-82	
Theophylline	7-23	86-344	 <p>Theophylline</p>
Paraxanthine	3-4	8-9	
Theacrine	0	11	
Liberine	5	7-110	
Methylxanthine	0	3	

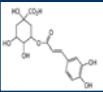
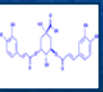
Caffeine content of several beverages (numbers between parentheses are ppm)

Beverage	Caffeine (in mg/150 ml)	
Roasted ground coffee	90	(600)
Instant soluble coffee	63	(420)
Decaffeinated coffee	3	(20)
Tea (leaf or bag)	42	(280)
Instant soluble tea	32	(213)
Cola	16	(107)
Chocolate or cocoa	4	(27)
Milk chocolate	3	(20)

Mechanisms of action of caffeine

- Inhibits adenosine A1 receptors, mediators of potassium and calcium exchange (brain, heart, trachea, kidney)
- Inhibits adenosine A2 receptors, mediators of relaxation of smooth muscles.
- Theophylline and paraxanthine more powerful than caffeine.
- Phosphodiesterases activities. (asthma attack)
- Mobilizes calcium stored in the endoplasmic reticulum, causes changes in nerve functions in secretion of neurotransmitters and muscle contraction.

Chlorogenic acids of arabica and robusta raw coffees (% db)

Component	Arabica	Robusta	
5-chlorogenic acid	3.0-5.6	4.4-6.5	 <p>chlorogenic acid</p>
4-chlorogenic acid	0.5-0.7	0.7-1.1	
3-chlorogenic acid	0.3-0.7	0.6-1.0	
Total	3.8-7.0	5.7-8.6	
3,4-dicaffeoylquinic acid	0.1-0.2	0.5-0.7	 <p>Dicaffeoylquinic acid</p>
3,5-dicaffeoylquinic acid	0.2-0.6	0.4-0.8	
4,5-dicaffeoylquinic acid	0.2-0.4	0.6-1.0	
Total	0.5-1.2	1.5-2.5	
3-feruloylquinic acid	Traces	0.1	
4-feruloylquinic acid	Traces	0.1	
5-feruloylquinic acid	0.3	1.0	
5-feruloyl, 4-caffeoylquinic acid	0	Traces	
Total	0.3	1.2	

Antioxidant activities of chlorogenic acids

Inhibition of:

- Lipoxygenase activity :prostaglandin metabolism
- Oxidation of vitamin A
- Retinoic acid epoxidation

Aliphatic acids in coffee (% db)

Component	Green coffee	Roasted coffee
Formic acid	Traces	0.06-0.15
Acetic acid	0.01	0.25-0.34
C3-C10 acids	Traces	Traces-0.03
Lactic acid	Traces	0.02-0.03
Citric acid	0.7-1.4	0.3-1.1
Malic acid	0.3-0.7	0.1-0.4
Fumaric acid	Traces	0.01-0.03
Oxalic acid	0-0.2	?
Quinic and quinidinic acid	0.3-0.5	0.6-1.2

Contains of Minerals

(A cup of instant coffee approx. 200 ml, corresponding to 2 g of coffee)

Mineral	Milligrams	Ppm
Sodium	1	5
Potassium	80	400
Calcium	3	15
Phosphorus	7	15
Iron	0.09	0.45
Copper	0.001	0.005
Zinc	0.01	0.05

Health benefits of coffee

Coffe and Parkinson's disease

Neurodegenerative disorder → Bradykinesia, tremor y rigidity

Degeneration of substantia nigra cells

Population over 55 (1%) and > 65 (3%)

Non drinkers 5.1X

Putative mechanims

Caffeine is Adenosine A2 receptor antagonist

Coffe as a souce of (NADPH) cofactor of glutatione reductase

Reduction of free radicals in substantia nigra

and biosynthesis of dopamine

Health benefits of coffee

Coffee and Cancer

Epidemiology

- Colonorectal cancer

Putative mechanisms

- Inhibit excretion of bile acids
- Increasing cholesterol

Antioxidant activities

- Chlorogenic acids (cafeic, cinnamic, ferulic etc)
- Purine derivatives (caffeine)

Stimulation of detoxification processes

- Glutatione S-Transferases

Health benefits of coffee

Coffee and Liver diseases

Clinical and Epidemiology data

- Serum glutamiltransferase
- Reduction of liver cirrhosis 5X
- Pro oxidant properties of ethanol
- P450 CYP-2E1

Biotransform ethanol
acetaldehyde

Conclusions

- The composition of coffee is very complex: it includes more than two thousand substances
- Not all of the components of coffee are known. Some of those that have been identified posses physiological effects. Caffeine is the most well known.
- to Determine if the results of experimental studies on animal the following criteria must be taken into consideration:
 - doses used
 - duration of coffee administration
 - metabolic characteristics of each animal species
- Caffeine is the only alkaloid in coffee that produces significant physiological effects

Conclusions

- The metabolism of coffee is complex. Its physiological effect can be explained in part by three mechanism:
 - antagonism of adenosine receptors
 - inhibition of phosphodiesterases
 - mobilizarion of intracellular calcium
- The only neurological effects that have been clearly demonstrated are increase in vigilance and the delay before onset of sleep. The caffeine contained in coffee elicitis a constriction of cerebral blood vessels. For this reason, it is present in many pharmaceutical products used to treat migraine headaches. Caffeine also potentiates the analgesic effect of some medications
- In healthy individuals, consumption of coffee in moderate amounts does not modify cardiovascular functions, or systolic and diastolic blood pressure.

Conclusions

- The gastric or intestinal intolerances that are sometimes attributed to coffee are linked to individual sensitivities and could not be reproduced in experimental studies
- Coffee exerts a cholecystokinetic action and increases external secretion of the pancreas
- Coffee consumption does not cause diseases of respiratory apparatus.
- Endocrine functions are not modified by consumption of coffee
- Consumption of coffee does not have any important effect on muscle function
- It has not been demonstrated that coffee consumption is a risk factor for bone fractures

Conclusions

- Coffee is a good source of potassium, manganese and fluoride.
- Coffee consumption increases energy metabolism in the hours following its ingestion but does not modify total energy expenditure
- Coffee consumption has no harmful effects on reproduction or fertility.
- Coffee in the usual amounts of human consumption does not have any teratogenic action.
- In the habitual amounts of human consumption, coffee does not have any genotoxic, mutagenic or carcinogenic potential