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Quercetin- A Mini Review

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Abstract

Quercetin a flavonoid to be a member of a group of flavonols is universally consumed in the human diet and responsibly to give the color to various fruits and vegetables [1]. Mainly occur in the form of glycosides, but their other derivative have been identified [2-5]. This paper presents some recent advances regarding quercetin structure, derivatives, sources and their medicinal benefits with their effective dosage [6-8].

Keywords: Quercetin; Derivatives; Plant sources; Medicinal benefits

Abbreviations: Fe-NTA: Ferric Nitrilo Triacetate; MIC: Minimum Inhibitory Concentration, NF- KB; Nuclear Factor Kappa B, MBC: Minimum Bactericidal Concentration, INOS: Inducible Nitric Oxide Synthase

Introduction

It is a 3, 5, 7, 3, 4-pentahydroxyflavon having the five hydroxyl groups placed at five different positions. [9] The chemical structure and different derivatives of quercetin presents in different food sources such as, Mango, plums, cranberry, blueberry, chokeberry, Buckwheat, honey, beans, lettuce, chicory, onion in different amount. Quercetin 3-O-galactoside, Quercetin 3-O-glucoside, Quercetin 3-O-glucuronide, Quercetin 7-O-glucoside, Quercetin 3-O-diglucoside and Quercetin 3-methyl ether are some derivatives that have been discovered in different plants [10-12] (Table 1 & Figure 1).

Table 1: Some important derivatives of quercetin and their food sources.

Derivatives	Food Sources	Contents (Mg/Kg)		References
		d.m.	f.m.	
Quercetin 3-O-galactoside	Mango	75-1469		[1]
	Plums		~ 36	[2]
	Blueberry		145-146	[3]
	Cranberry		96-97	
	Chokeberry		414-415	
	Lingon berry		117-116	
Quercetin 3-O-glucoside	Mango	78-1046		[1]
	Beans	101-692		[4]
	Plums		23-Nov	[2]
	Onions		Oct-38	[5]
Quercetin 3-O-xyloside Quercetin 3-O-rutinoside (rutin)	Mango	11-279		[1]
	Plums		27-78	[2]
	Cherries		17-136	[6]
	Tomatoes		3.21-9.22	[7]
	Buckwheat –leave	34-97 x 10^3	11-50 x 10^3	[8]
	Buckwheat – seeds	441-512		[9]
	Chokeberry		710-711	[7]

Quercetin 3-O-diglucoside	Beans	122-641		[4]
Quercetin 3,3'-dimethyl ether	Honey		0.3-2.1	[10]
Quercetin 3-O-glucuronide	Lettuce	0-732		[11]
	Chicory		80-1064	[12]
Quercetin 3-O-6''-acetylglucoside	Beans	Nov-52		[4]
Quercetin 3-O-6''-acetylglucoside	Beans	Nov-51		[4]
Quercetin 3-methyl ether	Honey		2-3.34	[10]
Quercetin 3-O-rhamnoside	Mango – fruits	0-118		[1]
	Pepper – fruits	112-991		[13]
	Cranberry		54-55	[3]
	Lingon berry		108-109	
Quercetin 7-O-glucoside	Beans	21-121		[4]
Quercetin 3,4'-diglucoside	Onions		168-1373	[5]

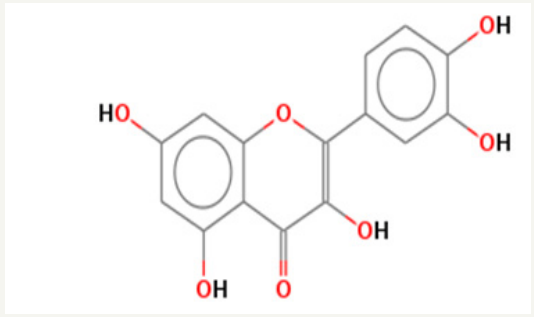

Figure 1: Chemical structure of quercetin.

Quercetin is one of the most abundant food based flavonoids present in various edible vegetables, fruit and wine [13]. Quercetin contents present in different plants sources are categorized in different categories such as, vegetable, fruit, plant, herb, shrub, beverage and others [14-16]. The most prominent sources of quercetin is canned capers 180.76mg/100g (Table 2). It has different medicinal benefits against brain disorder, renal injury, cardiovascular diseases, blood pressure, cancer, bacterial activity, inflammation, diabetes mellitus, arthritis and asthma [17-19]. Medicinal benefits of quercetin with effective dose concentrations presented in Table 3 [20-22].

Table 2: Various food sources and quercetin contents (mg/100g).

Food Sources		Quercetin contents	Food Sources		Quercetin contents
Vegetables	Ancho pepper	27.61	Fruits	Unsweetened apple sauce	2.01
	Raw broccoli	3.22		Raw apple with skin	4.43
	Cooked broccoli	1.07		Raw apricot	2.54
	Raw celery	3.51		Raw bilberry	3.05
	Canned green bean	1.5		Black grapes	2.56
	Raw green beans	2.74		Frozen blueberry	3.94
	Hot green raw chili pepper	16.81		Raw blueberry	3.12
	Hot wax raw yellow pepper	50.62		Raw cherry	1.24
	Iceberg lettuce	2.48		Raw cowberry	21.01
	Raw jalapeno	5.08		Canned sweet cherry	3.21
	Canned kale	4.51		Cherry raw tomato	2.78
	Raw kale	7.72		Raw cranberry	14.01
	Loose-leaf lettuce	1.94		Raw cranberry juice	16.42
	Boiled onions	19.37		Frozen chokeberry	8.91
	Red raw onion	19.94		Raw lemon without peel	2.3

	Serrano raw pepper	15.96		Lingo raw berry	12.17
	Raw spinach	4.87		Lingo berry juice	1.03
	Spring raw onion	14.23		Raw plums	1.21
	Sweet potato raw leave	20.55		Red raw currant	0.96
	Raw watercress	4.01		Red grapes	3.55
	White sweet raw onion	5.2		Frozen rowanberry	7.41
	Yellow snap raw beans	3.01		White raw currant	1.96
	Bog wild frozen whortleberries	17.71	**Herbs & shurbs**	Dill fresh weed	55.13
	Buckwheat	23.08		Queen Anne's Lace leave	1.11
	Buckwheat flour	2.71		European raw black currant	5.7
	Butterhead lettuce	1.2	**Beverages**	Black brewed tea	2.08
	Canned capers	180.76		Decaf brewed tea	2.85
	Raw chives	4.76		Decaf green brewed tea	2.76
	Dry unsweetened cocoa powder	20.14		Green brewed tea	2.7
	Raw coriander	5.01		Tomato canned juice	1.47
	Corn poppy leave	26.31	**Others**	Greek greens pie	12.41
	Raw dock leave	86.24		Marinara sauce	0.92
	Raw lovage leave	170.01		Canned tomato puree	4.13

Table 3: Medicinal benefits of quercetin with effective dose concentrations.

	Disease	Effective	Dosage	References
Medicinal benefits of quercetin	Neuron protective	Reverse the neurotoxicity in mice brain induced by d-galactose	5 and 10 mg/kg	[14]
		To protect the brain from the oxidative stress because act as a powerful antioxidant	100 mg/kg	[15]
		Play an important against memory defects such as Alzheimer's disease and cognitive impairment induced by lipopolysaccharide	25–100 mg/kg	[16]
	Renal injury	Diminished (Fe-NTA) ferric nitrile tri acetate oxidative renal injury	2 mg/kg	[17]
	Cardiovascular	Its modulate the production of nitric oxide and endothelin-1, thereby improve endothelial function and ultimately lead toward the beneficial Cardiovascular effects	200 mg	[19]
		Very effective to reduce HDL cholesterol significantly	500mg	
	Blood Pressure	Suppress the blood pressure in hypertensive patients	730 mg	[20]
	Cancer	Very effective in breast adenocarcinoma and inhibit the tumor growth	1 mg/kg	[21]
	Antibacterial activity	Inhibitory effects on Streptococcus mutans	MIC (2mg/ml), MBC (8 mg/ml)	[22]
		Inhibitory effects on Streptococcus sobrinus and Aggregatibacter actinomycetemcomitans	MIC (1mg/ml), MBC (8mg/ml)	
		Inhibitory effects on Lactobacillus acidophilus and Streptococcus sanguinis	MIC (2mg/ml), MBC (16mg/ml)	
		Inhibitory effects on Prevotella intermedia	MIC (4mg/ml), MBC (16mg/ml)	

	Anti-inflammatory	Improves the metabolic syndrome and also enhance the inflammatory status in obese rats	10 mg/kg	[23]
	Diabetes mellitus	In animal models very effective to control the fasting and postprandial blood glucose level	100 mg/kg	[24]
		In case of type-1 diabetes, very effective to significantly reduce the blood sugar level	10-15 mg/kg	[25]
		In streptozotocin-induced diabetic rats; effective to reduce the oxidative stress, iNOS overexpression and NF-κB activation,	150 μM/kg	[26]
	Arthritis	Effective to cause ease in arthritic pain and also helpful against the inflammation	750mg per day	[27]
	Immune System	Very effective against respiratory infections induced by excercise to protect cyclists	1000mg	
	Asthma	Relaxes the smooth muscle, provide therapeutic relief for asthma treatments	100μM	[28]

Conclusion

Quercetin generally exist in the edible plants and mostly used to manufacturing of traditional medicine to relieve some type of diseases [23-25]. In some recent studies quercetin exerts its biological properties in vivo. Overall, the best source of quercetin is canned carpers with 180.76mg/100g and followed by raw lovage leave with 170.01mg/100g [26-28].

References

1. Berardini N, Fezer R, Conrad J, Beifuss U, Carle R, et al. (2005) Screening of mango (Mangiferaindica L.) cultivars for their contents of flavonol O- and xanthone C-glycosides, anthocyanin's and pectin. J Agric Food Chem 53(5): 1563-1570.
2. Kim DO, Chun OK, Kim YJ, Moon HY, Lee CY (2003) Quantification of polyphenolics and their antioxidant capacity in fresh plums. J Agric Food Chem 51(22): 6509-6515.
3. Zeng W, Wang SY (2003) Oxygen radical absorbing capacity of phenolics in blueberries, cranberries, chokenberries and lingonberries. J Agric Food Chem 51(2): 502-509.
4. Chang Q, Wong YS (2004) Identification of flavonoids in Hakmeitau beans (Vignasinensis) by high performance liquid chromatog-raphy-electrospray mass spectrometry (LC-ESI/MS). J Agric Food Chem 52(22): 6694-6699.
5. Nemeth K, Piskuła MK (2007) Food content, processing, absorption and metabolism of onion flavonoids. Crit Rev Food Sci Nutr 47(4): 397-409.
6. Goncalves K, Landbo AK, Knudsen D, Silva AP, Moutinho PJ, et al. (2004) Effect of ripeness and posthar-vest storage on the phenolic profiles of cherries (Prunusavium L.). J Agric Food Chem 52(3): 523-530.
7. Slimestad R, Torskangerpoll K, Nateland HS, Johannessen T, Giske NH (2005) Flavonoids from black chokeberries, Aroniamelano-carpa. J Food Comp Anal 18: 61-68.
8. Kalinova J, Triska J, Vrchotova N (2006) Distribution of vitamin E, squalene, epicatechin and rutin in common buckwheat plants (FagopyrumesculentumMoech). J Agric Food Chem 54(15): 5330-5335.
9. Oomah BD, Mazza G (1996) Flavonoids and antioxidative activities in buckwheat. J Agric Food Chem 44(7): 1746-1750.
10. Yao L, Datta N, Tomas BFA, Ferreres F, Martos I, et al. (2003) Flavonoids, phenolic acids and abscisic acid in Australian and New ZelandLeptospermum honeys. Food Chem 81: 159-168.
11. Nicolle C, Carnat A, Fraisse D, Lamaison JL, Rock E, et al. (2004) Characterisation and variation of antioxidant micronutrients in lettuce (Lactucasativafolium). Science of Food and Agriculture 84(15): 2061-2069.
12. Innocenti M, Gallori S, Giaccherini C, Ieri F, Vincieri FF, et al. (2005) Evaluation of the phenolic content in the aerial parts of different varieties of Cichoriumintybus L. J Agric Food Chem 53(16): 6497-6502.
13. Materska M, Perucka I, Stochmal A, Piacente S, Oleszek W (2003) Quantitative and qualitative determination of flavonoids and phenolic acid derivatives from pericarp of hot pepper fruit cv. Bronowicka Ostra. Polish Journal of Food and Nutrition Sciences 12(suppl 2): 72-76.
14. Lu J, Zhenga YL, Luoc L, Wu DM, Suna D, et al. (2006) Quercetin reverses d-galactose induced neurotoxicity in mouse brain. Behav Brain Res 171(2): 251-260.
15. Naidu PS, Kulkarni SK (2004) Quercetin, a bioflavonoid, reverses haloperidol-induced catalepsy. Methods Find Exp Clin Pharmacol 26(5): 323-326.
16. Patil CS, Singh VP, Satyanarayan PSV, Jain NK, Singh A, et al. (2003) Protective Effect of Flavonoids against Aging- and Lipopolysaccharide-Induced Cognitive Impairment in Mice. Pharmacology 69(2): 59-67.
17. Singh D, Chander V, Chopra K (2004) Quercetin, a Bioflavonoid, Attenuates Ferric Nitrilotriacetate-Induced Oxidative Renal Injury in Rats. Drug Chem Toxicol 27(2): 145-156.
18. Loke WM, Hodgson JM, Proudfoot JM, McKinley JA, Puddey IB, et al. (2008) Pure dietary flavonoids quercetin and (-)-epicatechin augment nitric oxide products and reduce endothelin-1 acutely in healthy men. Am J Clin Nutr 88(4): 1018-1025.
19. Zahedi M, Ghiasvand R, Feizi A, Asgari G, Darvish L (2013) Does Quercetin Improve Cardiovascular Risk factors and Inflammatory Biomarkers in Women with Type 2 Diabetes: A Double-blind Randomized Controlled Clinical Trial. Int J Prev Med 4(7): 777-785.
20. Edwards RL, Lyon T, Litwin SE, Rabovsky A, Symons JD, et al. (2007) Quercetin reduces blood pressure in hypertensive subjects. J Nutr 137(11): 2405-2411.
21. Srivastava S, Ranganatha R, Somasagara, Hegde M, Nishana M, et al. (2016) Quercetin, a Natural Flavonoid Interacts with DNA, Arrests Cell Cycle and Causes Tumor Regression by Activating Mitochondrial Pathway of Apoptosis.
22. Shu Y, Liu Y, LiL F, Lou B, Zhou X, et al. (2011) Antibacterial activity of quercetin on oral infectious pathogens. 5(30): 5358-5361.
23. Rivera L, Morón R, Sánchez M, Zarzuelo A, Galisteo M (2008) Quercetin ameliorates metabolic syndrome and improves the inflammatory status in obese Zucker rats. Obesity 16(9): 2081-2087.
24. Kim JH, Kang MJ, Choi HN, Jeong SM, Lee YM, et al. (2011) Quercetin attenuates fasting and postprandial hyperglycemia in animal models of diabetes mellitus. Nutr Res Pract 5(2): 107-111.
25. Torres PM, Ortiz AR, Villalobos MR, Singh N, Medina FJL, et al. (2010) A comparative study of flavonoid analogues on streptozotocin-

nicotinamide induced diabetic rats: quercetin as a potential antidiabetic agent acting via 11beta-hydroxysteroid dehydrogenase type 1 inhibition. Eur. J Med Chem 45(6): 2606-2612.

26. Dias AS, Porawski M, Alonso M, Marroni N, Pilar S, et al. (2005) Quercetin decreases oxidative stress, NF-κB activation, and iNOS overexpression in liver of streptozotocin-induced diabetic rats. J Nutr 135(10): 2299-2304.

27. Harrison A, Ross Cooper R (2008) Quercetin: health benefits with relevance to TNF-α-linked inflammatory diseases. J Pre-clinical & clinical Res 2(2): 97-101.

28. Townsend EA, Emala CW (2013) Quercetin acutely relaxes airway smooth muscle and potentiates β-agonist-induced relaxation via dual phosphodiesterase inhibition of PLCβ and PDE4. Am J Physiol Lung Cell Mol Physiol 305(5): 396-403.