Pouteria genus

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POUTERIA GENUS: UPDATE OVERVIEW OF PHYTOCHEMICAL COMPOUNDS AND PHARMACOLOGICAL ACTIVITIES

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ABSTRACT

Species of Pouteria are widely spread in various countries. Pouteria is one of the genus that have diverse pharmacological activities. Pouteria's pharmacological activities and phytochemical compounds until 2019 are presented in this review article. Extraction methods which were used to isolate chemical compounds from Pouteria genus included maceration, Soxhlet, and percolation. Chemical compounds that have been widely isolated from Pouteria genus included phenols, flavonoids, and terpenoids group. Pouteria fruits, seeds, leaves, stems, bark, roots, and root bark have pharmacological activites such as immunomodulatory, cytotoxic, antimicrobial and antifungal, antidiabetic, antiplasmodial, and antimalarial. However, information on its use as a traditional medicine from Pouteria was poor. Further research is needed for the mechanism of action based on the pharmacological activites of chemical compounds.

Keyword: Pouteria, pharmacological activities, phytochemical compound

INTRODUCTION

Pouteria genus in one of the 53 genus[1] Sapotaceae family, which has 325[2] species and distributed in tropical and subtropical region.[3] Some species of Pouteria used as traditional medicine. The experiment of pharmacological activities can be based on a report the use of these plants as traditional medicine and chemical content. Silva et al. (2009) has reported the result for pharmacological activities and phytochemical compounds from Pouteria genus.[4] Information regarding pharmacological activities and phytochemical compounds of Pouteria genus were needed for developing Pouteria genus uses in pharmacy industries. Therefore, this article reported updating information concerning traditional uses, pharmacological activities, and chemical compounds of Pouteria genus.

Traditional Uses

The uses of Pouteria genus as traditional medicine can be shown in Table-1.

Tabel-1: The use Pouteria genus as traditional medicine

Species	Part of	Uses as traditional medicine	Ref.
Pouteria caimito	Leaves	for antimalaria, reduce pain, and wound healing	5
	Flesh of fruit	to relieve cough, bronchitis, and other lung disorders	6
	Latex	as a laxative	
Pouteria cambodiana (Pierre ex Dubard) Baehni	Stem bark	decoction of stem bark to facilitate breast milk	7
	Other parts	for nausea, vomiting, fever and relieve back pain	8,9
Pouteria ramiflora (Mart.) Radlk	Fruits and root	as anthelmintic, dysentery, and inflammation	
Pouteria campechiana (Kunth) Baehni	Stem bark	antipyretic and for healing injured skin	6, 10,11
	Peel of fruits	fever reducing medication	
	Leaves	decoction of leaves for diarrhea	
Pouteria sapota (Jacq.) H. E. Moore & Stern	Seed and seed oil	to reduce pain in the ear, to treat kidney stones, rheumatism, and digestive disorder	12

Several species of Pouteria genus were used as food material. The fruits of Pouteria was often consumed directly[13,14] and used as an additional ingredient in food such as in pudding.[15,16] In traditional medicine, *P. ramiflora* as antihyperlipidemic.[8,9] *P. campechiana*, was used for heart disease, liver, epilepsy, stomach diseases, and skin disruption.[10] Other species of Pouteria genus was apllied for inflammation, diabetes, indigestion,[3,17] diarrhea,[18] nausea, throw up and relieve back pain.[19]

Phytochemical Compounds of Pouteria Genus

Phytochemical compounds are important components in plants. It can be isolated from the initial extraction step. The extraction method and solvent used will affect the resulting.[20] The extraction method can be influenced by the type and amount of phytochemical compounds which was isolated. In this review, information updated regarding phytochemical compounds of Pouteria genus up to 2019, was presented in Table-2. Flavonoid, phenolic compounds and terpenoid were secondary metabolite isolated from Pouteria genus.

Tabel-2: Phytochemical Compounds of Pouteria up to 2019

Phytochemical compounds	Species	Part used	Extraction method	Solvent	Ref.
Flavonoid					
Myricetin	*P. campechiana*	Leaves and seed	Maceration	EtOH 70%	21
		Leaves	Soxhlet	Acetone	22
	P. torta	Leaves	Percolation	EtOH-Water (7:3)	23
Myricetin-3-O-β-galactoside; Myricetin-3-O-α-L-rhamnoside	*P. campechiana*	Leaves and seed	Maceration	EtOH 70%	21
Quercetin	*P. sapota*	Fruits	Soxhlet	EtOH 99%	24
	P. campechiana	Leaves	Maceration	EtOH 70%	21
		Seed			
Quercetin 3-O-α-rhamnopyranoside; Quercetin 3-O-β-arabinopyranoside; Taxifolin 3-O-α-arabinofuranoside; Trans-taxifolin 3-O-α-arabinopyranoside; Taxifolin 3-O-α-rhamnopyranoside	*P. campechiana*	Leaves	Maceration	Methanol	25
Phenolic compound					
Gallat acid	*P. campechiana*	Leaves and Seed	Maceration	Ethanol 70%	21
	P. macrophylla	Fruits		Water	26
Terpenoid					
a. Neoxanthin; b. (9'Z)-Neoxanthin c. Capsoneoxanthin d. Capsoneoxanthin	*P. sapota*	Ripe Fruit	Homogenized with acetone	Acetone	27
a. α- and β- amyrin; b. Lupeol; c. α-amyrin acetate; d. Ψ-taraxasterol acetate	*P. gardneri*	Leaves	Maceration	n-Hexane	28
a. ursolic b. asam oleanolic	*P. gardneri*	Leaves	Maceration	Ethanol	

Monoterpene (α-Pinene)	*P. elegans*	Ripe fruits	HS-SPME technique		29
a. sapotexanthin 5,6-epoxide; b. sapotexanthin 5,8-epoxide; c. cryptocapsin; d. capsanthin 5,6-epoxide	*P. sapota*	Ripe fruits	Homogenized in mortar	Acetone	30
a. Friedelin b. *Epi*-friedelanol	*P. ramiflora*	Leaves	Maceration	n-Hexane	31
taraxerol	*P. ramiflora*	Leaves	Maceration	n-Hexane	
	P. venosa	Leaves, bark, stem bark	Maceration	Ethanol	17
a. Spinasterol; b. Three triterpenes fatty acid ester	*P. campechiana*	Stem bark	Maceration	Ethyl acetate	32
a. β-cryptoxanthin-5,6-epoxide; b. β-cryptoxanthin-5′,6′-epoxide; c. 3′-Deoxycapsanthin d. Cryptocapsin	*P. sapota*	Fruits	Homogenized with $NaHCO_3$	Acetone	33
a. Cryptocapsin-5,6-epoxide; b. 3′-deoxycapsanthin-5,6 epoxide; c. cryptocapsin-5,8-epoxides	*P. sapota*	Fruits	Homogenized with $NaHCO_3$	Acetone	34
a. 3'-deoxycapsorubin b. 3,3'-dideoxycapsorubin	*P. sapota*	Fruit	Homogenized with $NaHCO_3$	Acetone	35
Sapotexanthin (all-E,5'R)-β,κ-caroten-6'-one	*P. sapota*	Fruit	Homogenized with $NaHCO_3$	Acetone	36

Other terpenoid compounds that have isolated included α-amyrin and lupeol. These compounds were found in *P. torta* fruits and flower[4,37]and *P. caimito* fruits.[38] α-amyrin acetate and β-amyrin were presented from stem bark extract of *P. tomentosa*,[4,39] *P. torta*[40] and *P. gardneri* leaves extract.[4,41] β-amyrin acetate and betulinic acid were isolated from methanol leaves extract of *P. torta*[40] and *P. tomentosa*.[4,39] Ursolic acid was reported from several species of Pouteria, included *P. venosa* extract[17], *P. gardnerii* extract[4,41] and *P. tomentosa*[4,39] extract. *Taraxerol* was reported in *P. caimito* extract[38,42], and *P. venosa* extract[17]. While carotenoids were found in *P. cambodiana* extract.[18]

The other phenolic groups which were isolated from Pouteria, include gallic acid, (+)-gallocatechin, (+)-catechin, (-)-epicatechin, (+)-catechin-3-O-gallate epicatechin, (+)-catechin-3-gallate and myricitrin from *P. campechiana*, *P. sapota* and *P. viridis* extracts.[3] Myricitrin has been also isolated from *P. torta* extract.[4] Stilbenes and protocatechuic acid have been isolated from *P. cambodiana* extract.[19,7] Besides that, four of dihydroflavonol glycoside were isolated from methanol-water (80:20) extract *P. obovata*.[43]

Pharmacological activities

Pharmacological activities has been reported by Silva[4] such as antioxidant activity, immunomodulatory activity, cytotoxic, antibacterial, anti fungicidal, inflammation, allelopathy, antimalaria, antitermit and for HIV diseases therapy. Pharmacological activities of Pouteria genus was exposed in Table-3.

Tabel-3: Pharmacological activities of Pouteria genus

Species	Part of							Pharmacological activities	Ref.
	R	RB	F	S	St	StB	L		
P. torta	+		+	+	+	+	+	a. Leaves: cytotoxic effect on *Artemia salina*, breast tumor cell, antimutagenic, antiplasmodial, active to α-glucosidase and α-amylase. b. Stem and root: active as antiplasmodial c. Fruits: active to α-glucosidase d. Stem bark: active to α-glucosidase and α-amilase	13, 18 23, 44, 45, 46,
P. ramiflora	+	+	+	+	+	+	+	a. Root extract: active as antinosiseptic, antiinflammation and antiplasmodial b. Leaves extract: active to α-glucosidase, α-amilase, as antioxidant, antinosiseptic, antiinflammation, and antiplasmodial c. Stem and stem bark: active as antiplasmodial	8, 13, 31, 44
P. gardneri		+					+	a. Root bark: active as antileishmanial and trypanocidal b. Leaves: active to α-glucosidase and α-amilase	44, 47

P. caimito			+		+		+	a. Leaves: active as antioxidant, α-glucosidase and α-amilase, antimicroba for *Pseudomonas aeruginosa*, *Bacillus cereus,* and *Candida albicans* b. Fruits: active to acetylcholinesterase, and antimicroba for *C. albicans, S. aureus, B. cereus, E. coli, S. typhimurium* and toxicity effect to *Artemia salina*	14, 5, 44, 47, 48, 49
P. lucuma			+	+				a. Seed: active as antioxidant and gastroprotective b. Fruit: active as antioxidant and to α-amylase.	50, 51
P. macrophylla			+					Gallic acid in water extract fruit active as antioxidant	26
P. venosa					+	+	+	Leaves, stem and stem bark active as antioxidant, antimalaria and anticholinesterase and active as antimycrobial	17, 52
P. reticulata						+		Stem bark extract can inhibit to *Mycobacterium tuberculosis*	53
P. cambodiana						+		Water extract of stem bark active as immunomodulatory	19
P.campechiana			+	+	+	+	+	a. Fruits extract as antioxidant and hepatoprotective b. Stem bark as antioxidant and antihaemolytic c. Seed extract active as antiinflammation, analgesic, and antiulcer d. Leaves extract as antioxidant, antimytosis, antiinflammation, analgesic, antiulcer, antinocyceptic, antihyperalgesic and toxic to *Aedes aegypti*	10, 21, 22, 23, 32, 54, 55, 56, 57, 58, 59, 60, 61

								and *Culex quinquefasciatu*	
P. mammosa					+			Toxicity effect to irritation of eye and skin	62
P. sapota			+					Extract methanol- acetate acid (85:15) active as antioxidant to DPPH, and lipophilic and hydrophilic extract as an antioxidant to DPPH and FRAP	63, 64

Note: R: root, RB: root bark, F: fruit, S: seed, St: stem, StB: stem bark

Antioxidant Activity

Antioxidant activity was the most reported from Pouteria genus. Some extracts and fractions of Pouteria active as antioxidant. Many species of Pouteria have antioxidant activities included methanol extract of stem bark *P. cambodiana* with IC_{50} against DPPH 0.24 mg/ml,[7] acetone extract, methanol and acetone fractions of *P. campechiana* fruit,[3] ethanol and water extracts of *P. campechiana* fruits with different level maturity of 4, 8, 12, 16, 20 and 24 weeks as antioxidant against DPPH, FRAP and ABTS with variation inhibition.[65] Besides that, leaves extract of *P. ramiflora*[8] and *P. venosa*,[17] *P. viridis* fruits extract[3] and *P. splendens* leaves[66] had antioxidant activity. Antioxidant activity of *P. caimito* leaves extract had the smallest IC_{50} of 36.1 µg/ml compared to n-hexane and ethanol extracts.[5] The phenolic group can contribute to antioxidant activity. Phenolic compound of methanol-acetic acid (85:15) fruit extract of *P. sapota* showed antioxidant activity.[31] Beside the phenolic group, the carotenoid group can also contribute to antioxidant activity. Ethanol extracts of *P.campechiana* fruits that were stored for 2, 4, 6, 8, 10 and 12 days gave increasing in total carotenoid content and followed by increasing in antioxidant activity.[57]

Antibacterial and Anti fungicidal

The phenolic group can contribute to antibacterial and anti fungicidal activities. Leaves extract of *P. grandiflora*, *P. psamophila*,[67] *P. pallida*,[68] *P. splendens* and *P. torta*,[4,69] stem of *P. reticulata*,[53] were reported as antibacterial. Seed of *P. torta*,[70] leaf of *P. psamophila* and *P. grandiflora*[67] was expressed as anti fungicidal. Besides that, linoleic acid, spinasterol, 3β, 28-dihydroxy-olean-12 enil ester, and betulinic acid from stem bark *P. campechiana* can be inhibited *E. coli* and *P. aeruginosa* and also *C. albicans* and *Trichophyton mentagiophyte*.[32]

Other Pharmacological Activites

Methanol extracts of *Pouteria cambodiana* stem bark[7] and *P. campechiana* leaves[60] was reported to have immunomodulatory activity. *P. gardnerii*, *P. ramiflora* dan *P. torta* extracts did not show active against *Aedes aegypti*, *Rhodnius milesi* and *Dipetalogaster maxi*.[4] N-hexane-ethyl acetate (1:1) fraction of *P. venosa* active against *A.aegypti*.[17]
P. ramiflora water extract and fraction of the ethanol extract of *P. torta* leaves[18] and methanol extract of *P. torta* leaves[66] were revealed to possess toxicity effect towards *Artemia salina*. While stem bark, lignum and root of *P. guianensis* have no toxicity effect towards *Artemia franciscana*.[49,71] Pouterin compound from *P. torta*

showed insecticidal effect against *Callosobruchus maculatus*, also has the ability to agglomerate erythrocytes in humans, rabbits and mice.[70] The other researches stated that stem extract of *P. sapota* active as antiplasmodium[72] and leaves extract of *P. venosa* as antimalaria.[17] Hydroethanol of stem and stem bark extracts of *P. guianensis* active as anti-termite against Nasutitermes sp.[73]

Wood root extract of *P.torta* have cytotoxicity effect against HCT-8 (human colon carcinoma) with IC_{50} 37.9 µg/ml, HL-60 (leukemia) with IC_{50} 31.7 µg/ml, SF-295 (Brain) with IC_{50} 30.2 µg/ml and MDA-MB-435 (melanoma) with IC_{50} 21 µg/ml.[74]

Methanol leaves extract of *P. viridis* active as anti-HIV.[75] N-hexane leaves extract of *P. torta* active as antagonist estrogen at estrogen beta (ER_{β}) receptor.[76]

P. gardnerii, P. ramiflora, P. torta, and *P. caimito* have been tested for as inhibitor tyrosinase. Water leaves extract of *P. torta* and *P. caimito* active as an inhibitor of tyrosinase with IC_{50} 30.01 µg/ml and 50.01 µg/ml and ethanol leaves extract of *P. ramiflora* and *P. torta* showed IC_{50} 249.83 µg/ml and 104.34 µg/ml.[77]

CONCLUSION

Based on the literature, species of Pouteria which have presented to came from subtropical and tropical areas such as in North America, Central America, and Asia. Some pharmacological activities and phytochemical compounds of Pouteria genus have been widely stated. Extracts of Pouteria genus were demonstated to have some biological activities, however information concerning treatment the skin and biological activity of fraction and chemical compound of Pouteria genus was less. In addition, so far information on the mechanism of chemical compound from Pouteria genus guided by pharmacological activities has not been found.

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