IJPSR (2020), Volume 11, Issue 2 **(Review Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 14 May 2019; received in revised form, 29 July 2019; accepted, 27 January 2020; published 01 February 2020

A REVIEW ON NATURAL CHALCONES AN UPDATE

Ramya Kuber Banoth * and Ashwini Thatikonda

Institute of Pharmaceutical Technology, Sri Padmavati Mahila Visvavidyalayam (Women's University), Tirupati - 517502, Andhra Pradesh, India.

Keywords:

Chalcones, Secondary metabolites, Cytoprotective, Natural products, Modulatory, Pharmacological screening

Correspondence to Author:
Ramya Kuber Banoth

Associate Professor,
Institute of Pharmaceutical Technology, Sri Padmavati Mahila Visvavidyalayam (Women's University), Tirupati - 517502, Andhra Pradesh, India.

E-mail: rkuberpharma@yahoo.com

ABSTRACT: Plants are a valuable source of secondary metabolites. Many phytochemicals are obtained from the plant sources that are used as valuable medicinal agents. Chalcones are one of the important secondary metabolites obtained from many edible plants like foods, vegetables, tea, spices and natural foodstuffs. Chalcones considered as obligate intermediated in flavonoid biosynthesis but they do not accumulate to an appreciable degree in most plants. Chalcones are a group of plant-derived polyphenolic compounds belonging to the flavonoids family that possess a wide variety of cytoprotective and modulatory functions, which may have therapeutic potential for multiple diseases. The largest number of natural chalcones has been isolated from species of the Leguminosae, Asteraceae and Moraceae families. Chalcone accumulating plants have often been used in traditional medicine and These chalcones and their derivatives have shown important antimicrobial, antifungal, anti-mycobacterial, antimalarial, antiviral, anti-inflammatory, antioxidant, anti-tumor, antileishmanial, anticancer properties. The purpose of this review is to summarize the various naturally occurring chalcone compounds which have been isolated from different plants and to describe the recent efforts of scientists in a pharmacological screening of chalcones, studying importance of chalcones and their biological activities.

INTRODUCTION: Chalcones are a group of phenolic or flavonoid compounds widely distributed in plant kingdom [1]. They are both intermediates and end products in flavonoid synthesis, act as defensive compounds, participated in pathogens interactions and contribute to the medicinal value of herbs [2]. Naturally occurring chalcones and their synthetic derivatives show a wide spectrum of biological activities [3]. For these reasons, chalcones are an object of continuously growing interest amongst scientists [4].

Chalcones are belonged to the largest class of plant secondary metabolites and are considered to be precursors of flavonoids and isoflavonoids [5]. They serving in plant defense mechanisms to counteract reactive oxygen species in order to survive and prevent molecular damage and attack by microorganisms, insects and animals [6]. Chemically, chalcones or 1,3-diaryl-2-propen-1-one **Fig. 1** consist of open chain flavonoids in which two aromatic benzene rings are joined by a three-carbon enone moiety, α, β- unsaturated carbonyl system [7].

QUICK RESPONSE CODE

DOI:
10.13040/IJPSR.0975-8232.11(2).546-55

This article can be accessed online on
www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.11(2).546-55

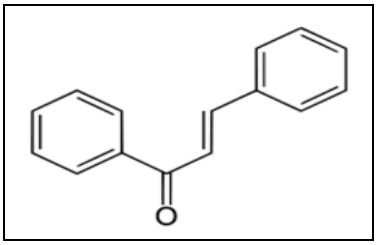
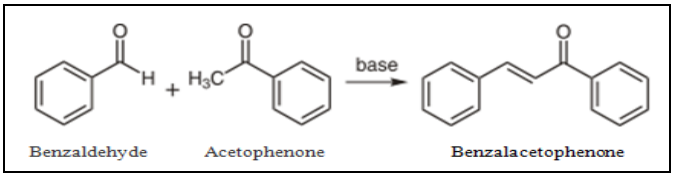


FIG. 1: STRUCTURE OF CHALCONE

Synthetic Method of Preparing Chalcones: Although chalcones occur naturally, they could be available in larger amounts through an efficient synthesis method. Chalcones can be prepared by any two condensation reactions namely:

Claisen Schmidt Condensation: The most convenient method is the Claisen-Schmidt condensation of equimolar quantities of aryl methyl ketone (acetophenone) with aryl aldehyde (benzaldehyde) in the presence of alcoholic alkali (sodium hydroxide) as a catalyst.



SCHEME 1: REACTION OF CLAISEN SCHMIDT CONDENSATION

This method of reaction has been found without any solvent as a solid-state reaction. It can be used as an example of green chemistry synthesis in undergraduate education [8].

Aldol Condensation: Acetophenone and benzaldehyde are the starting materials for this reaction. First, acetophenone is treated with a base like KOH which converts it into the more active form, its enolate form.

It will then react with benzaldehyde to form intermediate. The intermediate will then lose water molecule by heat to form chalcone [9].

$$C_6H_5CO\text{-}CH_3 + O{=}CHC_6H_5 \rightarrow C_6H_5CO\text{-}CH{=}CHC_6H_5$$

Acetophenone Benzaldehyde Benzalacetophenone

SCHEME 2: REACTION OF ALDOL CONDENSATION

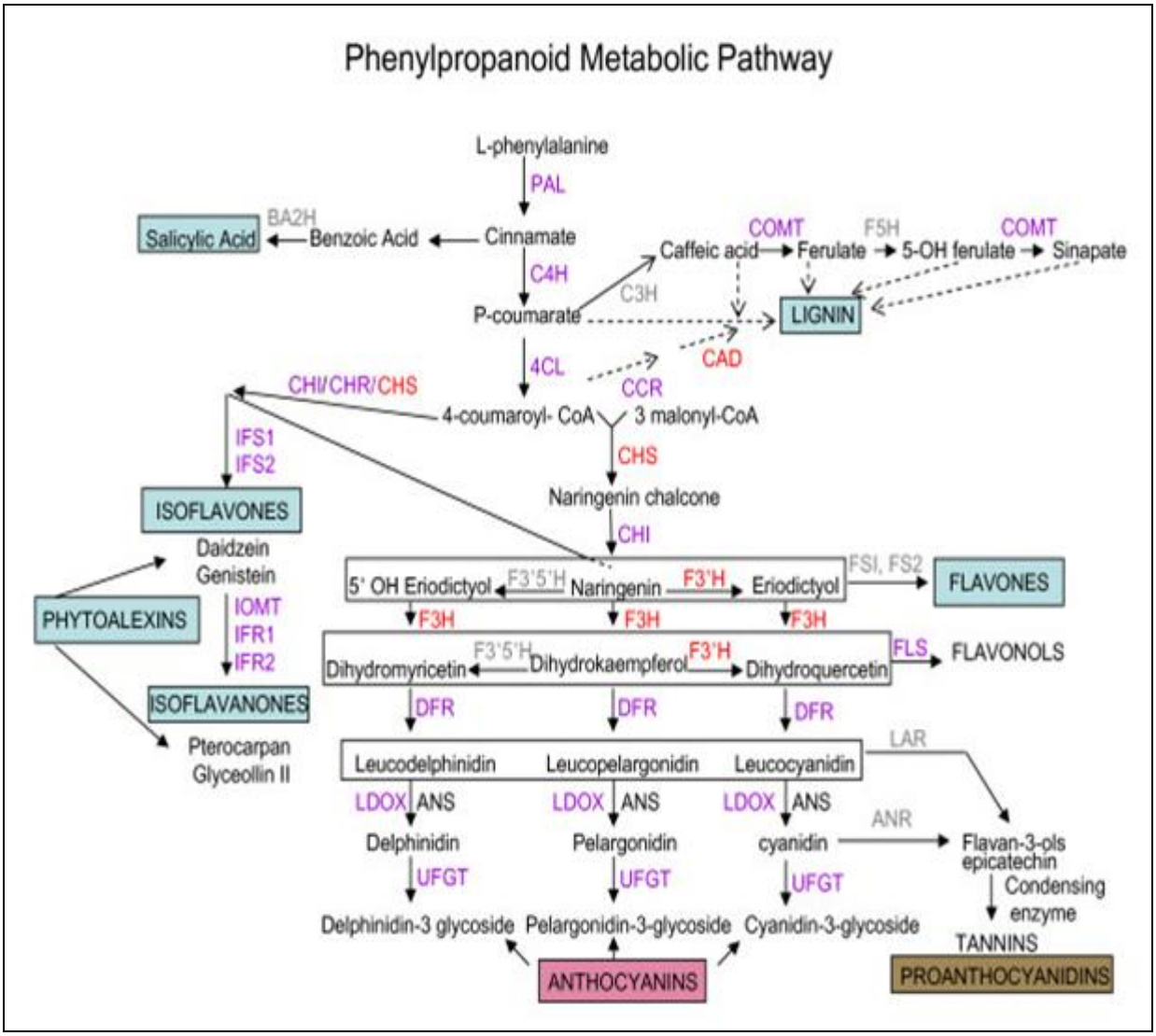


FIG. 2: PHENYLPROPANOID BIOSYNTHESIS PATHWAY

Biosynthesis of Chalcones: Chalcones or benzylideneacetophenone are the important constituents of natural products and have been reported to possess varied biological and pharmacological activity [10]. In higher plants, chalcones are synthesized by the enzyme *Chalcone synthase* from one molecule of *p*-coumaril-CoA and three molecules of malonyl-CoA. The amino acid L-phenylalanine, which is formed in the shikimic acid pathway, is converted to *p*-coumaril-CoA through the phenylpropanoid pathway, resulting in the formation of the aromatic B-ring and the 3C bridge of chalcone (C_6-C_3-). The aromatic A-ring is formed after the condensation of three molecules of malonyl-CoA (-C_6).

Once synthesized, chalcone has three main destinations in plant metabolism. It can be used to produce aurones by the Aureusidin synthase; to form glycosyl conjugates, which are yellow flower pigments that accumulate in plants; and in most cases, it can be converted to naringenin by the action of Chalcone isomerase. Chalcone isomerase "type I", broadly found in higher plants (except leguminous plants) produces the 5-hydroxyflavanone naringenin, which is the biosynthetic precursor of virtually all flavonoids (flavones, isoflavones, flavonols, condensed tannins, and anthocyanins) [11].

Natural Occurrence of Chalcones: 2-hydroxyl-4,6-dimethoxy-3-methylchalcone and 2,4-dihydroxy- 5- methyl- 17, 6- methoxy chalcone, named aurentiacin A and aurentiacin B, respectively, were isolated from *Dydimocarpus aurentica* [12]. Triangularin-2′, 6′-dihydroxy- 4′-methoxy-3′-methylchalcone has been isolated from the exudate farina of the ceroptin chemotype of *Pityrogramma triangularis* [13]. From the fruits of *Myrica gale* the isolation of 2′,6′-dihydroxy-4′-methoxy-3′,5′-dimethyldihydrochalcone, and 4,4,6-trimethyl- 2- (3-phenylpropionyl)-cyclohexane-1,3, 5-trione [14] . Rubone, a new chalcone isolated from *Derris robusta* seed shells [15]. A new Bakuchalcone, dihydrofuranochalcone has been identified in seeds of *Psoralea corylifolia* [16]. Several known chalcones, a new isoflavone, a dihydrochalcone and three chalcone derivatives lapathinol, lapathone, angelafolone, valafolone and melafolone were isolated from *Polygonum lapathifolium* [17]. Brackenin, a new dimeric dihydrochalcone isolated from *Brackenridgea zanguebarica* [18]. A new prenylated flavanone, oaxacacin, and its chalcone, mixtecacin have been isolated from roots of *Tephrosia woodii* [19]. A complex mixture of chalcones and flavanones, 1, 3, 4- trimethoxy derivatives and dimethylallyl groups and methoxy derivatives were obtained from *Helichrysum rugulosum* [20]. Two dihydrochalcones, 2′, 6′-dihydroxy-4′-methoxydihydrochalcone and 2,4′,6′-trihydroxydihydrochalcone have been isolated from leaves of *Lindera umbellate* [21]. Isoliquiritin and licuraside both of which are kinds of chalcones, identified from *Glycyrrhizae radix* [22].

Four new chalcones, xanthangelols B-E were isolated from roots of *Angelica keiskei* [23]. 2'-hydroxy- 4, 4'- dimethoxychalcone was isolated from green parts and flower heads of *Bidens tripartitus* [24]. Two new β-hydroxychalcones named ponganones I and II were isolated from the root bark of *Pongamia pinnata*.

The structures were characterized as 7-hydroxy-2'5'-dimethoxy-[6", 6"-dimethylpyrano(2", 3": 4', 3')] chalcone for ponganone-I, and 7-hydroxy-2', 5'-dimethoxy-3, 4-methylenedioxy-[6", 6"-dimethyl-pyrano (2",3",4',3')] chalcone for ponganone II [25]. A new diprenylated chalcone stipulin has been characterized from the roots of *Dalbergia stipulacea* [26]. A new dihydroxy chalcone 3, 3' -dihydroxychalcone, 3' -methoxyflavone and beta-sitosterol have been isolated for the first time from the whole plant of *Primula macrophylla* [27]. Spinochalcones A and B, flemistrictin A chalcones were isolated from roots of *Tephrosia spinosa* [28].

Two new chalcones, calythropsin and dihydrocalythropsin isolated from the crude extract of *Calythropsis aurea* [29]. From the aerial parts of *Boronia inconspicua* two novel dihydrochalcones, 2',4, 4', 6'-tetrahydroxy-5-(E-3, 7-dimethylocta-2, 6-dienyl)-3-(3-methylbut-2-enyl) dihydrochalcone and 2',4,4',6'- tetrahydroxy-3,5-di(3-methylbut-2-enyl) dihydrochalcone have been isolated and identified [30]. Chalcone pedicin, two new condensed chalcones, fissistin and isofissistin were also obtained from ethyl acetate extract of *Fissistigma lanuginosum* [31]. A new triterpene, methyl-3-epi-betulinate in its native form and 4′,6′-dihydroxy-2′-methoxy-3′,5′-dimethyl chalcone isolated from the aerial parts of *Syzygium samarangense* [32].

Munchiwarin, a chalcone with the 2, 2, 6-tri-isoprenyl-cyclohex-5-ene-1, 3-dione skeleton, was isolated from *Crotalaria trifoliastrum* [33]. Flavonoids, syzalterin, L-farrerol and L-liquiritigenin and the chalcone isoliquiritigenin were isolated from fresh flowering bulbs of *Pancratium maritimum* L. [34] α-hydroxydihydro-chalcone (α,4,2′-trihydroxy-4′-O-geranyldihydro-chalcone), a new isoflavone norisojamicin have been isolated from the stem bark of *Millettia usaramensis* [35]. 2', 3'-Dihydroxy-4' 6'-dimethox-chalcone and the corresponding dihydrochalcone were isolated from the leaves of *Uvaria dulcis* [36]. Prorepensin was isolated from the extract of the dried powdered twigs of *Dorstenia prorepens. Dorstenia zenkeri* yielded p-hydroxybenzaldehyde, dorsmanin A, 4,2,4- trihydroxychalcone and 4,2,4-trihydroxy-3-prenylchalcone [37]. L-hydroxypandu-ratin A, panduratin A, sakuranetin, pinostrobin, pinocembrin and dihydro-5,6-dehydrokawain were isolated from red rhizome variety of *Boesenbergia pandurate* [38].

A new prenylated chalcone Artoindonesianin J isolated from the root bark of *Artocarpus bracteata* Hook [39]. Pure lonchocarpin and derricin were isolated from *Lonchocarpus sericeus* Kunth [40]. Xanthoangelol, isobavachalcone, Xanthoangelol H, laserpitin, isolaserpitin, 3'-senecioyl khellacone, 4'-senecioyl khellactone, selinidin, pteryxin, (3' R)- 3'-hysroxycolumbianidin, mumdulea flavanone A, prostratol F, falcarindiol and 5- N- penta-decylresorcinol were isolated from the exudate of *Angelica keiskei* [41]. Three sweet dihydrochalcone glucosides tribatin 2"-acetate, phloridzin and trilobatin from the leaves of *Lithocarpus pachyphyllus* (Kurz) [42].

Three novel chalcone derivatives, mallo-to-philippens C, D, and E were isolated from the fruits of *Mallotus philippinensis* [43]. Two new chalcone 2′, 6′-dihydroxy-4-isopenteniloxy-3, 4-(3″,3″-dimeth-ylpyrano) chalcone and 4,2′,6′-trihydroxy-3′,4′-metilenodioxo-3-isopentenilchalcone were isolated from the wood ethanolic extract of *Beilschmiedia tovarensis* [44]. 2′-hydroxy-4′, 6′-dimethoxy-3, 4-methylenedioxy chalcone was isolated from the leaves of *Bauhinia variegata* [45]. A new flavanone, 7-hydroxy-5,6-dimethoxyflavanone together with three other flavonoids, didymocarpin, 2',4'-dihydroxy- 5' 6'- dimethoxychalcone and isodidymocarpin had been isolated from the methanol extract of the tree bark of *Cryptocarya costata* [46]. Three new chalcones, xanthokeismins A, B and C in addition to a known chalcone, Xanthoangelol B from the stem of *Angelica keiskei* [47]. Garcinol, the antioxidant chalcone isolated from *Garcinia indica* Choisy [48]. Isocordoin and 2',4'-dihydroxy-3'-(dimethylallyl)-dihydrochalcone were isolated from the root of *Lonchocarpus xuul* [49]. The phytochemical analysis of the plant *Bacopa monnierie* reveals that it contains a chalcone type of compound 2, 4, 6-trihydroxy-5-(3,3-dimethyl propenyl)-3-(4-hydroxyphenyl) propiophenone [50]. Two new chalcone derivatives morachalcones B and C were isolated from the leaves of *Mora alba* L. [51]

Hybrid flavan-chalcones, desmosflavans A and B, together with three known compounds, cardamonin, pinocembrin and crysin were isolated from leaves of *Desmos cochinchinensis* [52]. Eight chalcone derivatives as the active principles, including licochalcone G, licochalcone A, echinantin, 5-prenylbutein, licochalcone D, isoliquiritigenin, licoagrochalcone A and kanzonol C from the *Glycyrrhiza inflata* [53]. Two new chalcone glycosides 4'-O-(6"-O-galloyl-β-d-glucopyranosyl)- 2',4-dihydroxychalcone and 4'-O-(6"-O-galloyl-β-d-glucopyranosyl)- 2'-hydroxy-4-methoxychalcone together with one known chalcone glycoside 4'-O-β-d-glucopyranosyl- 2'-hydroxy-4-methoxychalcone were isolated from the stems of *Entada phaseoloides* [54]. A new flavanone (mildbone) and a new chalcone (mildbenone) have been obtained from African Erythrina species, *Erythrina mildbraedii* of Cameroon [55].

Four flavonoids were obtained and their structures were identified as 3- hydroxy- 4- methoxylon-chocarpin a new prenylated chalcone, 4-methoxylonchocarpin, isobavachromene and dorspoinsettifolin were isolated from the seeds of *Millettia pachycarpa* [56]. A new acetylated chalcone glycoside, trans-2' 6'-dihydroxy- 4'- O-(4"-acetyl-rhamnoside)- 4- methoxychalcone and a new biflavonoid glycosides, 5,3',5", 4'"-tetrahydroxy-3'", 5'"dimethpxy- biflavone (4'→8")- 7- O- ((2-rhamnoside) rhamnoside) were isolated from the ethyl acetate soluble fraction of the methanol extract obtained from *Trigonosciadium brachytaenium* [57].

Three new chalcone dimers oxyfadichacones A, B and C along with four known chalcones, 2',4'-dihydroxychalcone, 2',4',4-trihydroxychalcone, 2'-hydroxy-4'-methoxychalcone and 2',4'-dihydroxy-4-methoxychalcone, were yielded and identified from *Oxytropis falcata* [58]. Bractelactone, a novel chalcone from *Fissistigma bacteolatum* [59].

Nardokanshone A, a new type of sesquieterpenoid-chalcone hybrid isolated from *Nardostachys chinensis* [60]. Two new diprenylated dihydro-chalcones, elastichalcone A1 and elastichalcone B2 were isolated from the leaves of *Artocarpus elasticus* [61]. Three new chalcones, 3, 2'-dihydroxy-4,3'-dimethoxychalcone-4'-glucoside, 4'-O-(2'''-O-caffeoyl)-2',3',3,4-tetrahydroxychalcone and 2',4',3-trihydroxy-3',4-dimethoxychalcone were isolated from *Coreopsis lanceolate* flowers [62].

Chalcone dimers Lophirone B and C compounds were isolated from *Lophira alata* [63]. A new prenylated chalcone xanthohumol-M, bichalcone humulusol and six known chalcones were found from *Humulus lupulus* [64]. Bis-dihydrochalcone diglucoside containing a cyclobutene ring, a methylene-bridged bischalconeglycoside, both probably dimers of the co-occuring isosalipur-poside, and seven known naringenin, apigenin, kaempferol and luteoline glucoside identified and isolated from extract of the air-dried aerial parts of *Helicrysum zivojinii* [65]. Cardamonin, a schistoso-micidal chalcone from *Piper aduncum* L. (Piperaceae) that inhibits *Schistosoma mansoni* ATP diphosphohydrolase [66].

Six new flavonoids *2′*,4′-dihydroxychalcone-6′-O-β-D-glucopyranoside, α, 3, 2′, 4′-tetrahydroxy-4-methoxy-dihydrochalcone-3′, -C-β-glucopyranosy-6′- O- β- D- glucopyranoside, 7- hydroxy- 5, 8′-dimethoxy- 6′α- L- rhamnopyranosyl- 8- (3-phenyl-trans-acryloyl)- 1- benzopyran- 2- one, 6′, 7-dihydroxy-5, 8- dimethoxy- 8 (3- phenyl- trans-acryloyl)- 1- benzopyran- 2- one, 9- hydroxy-3, 8-dimethoxy- 4- prenylpterocarpan and α, 4, 4′-trihydroxydihydrochalcone-2′-O-β-D-glucopyrano-side were isolated from bark of *Eysenhardtia polystachya* [67]. Two chalcones, sappanchalcone and 3-deoxysappanchalcone were isolated from the ethanolic extract obtained from *Haematoxylum campechianum* L. [68] Two chalcone derivatives isolated from Finger root with nutraceutical potentials [69]. Flavokawain B, pinostrobin and pashanone chalcones were isolated from seeds of *Persicaria lapathifolia* [70].

TABLE 1: LIST OF CHALCONES FROM MEDICINAL PLANTS

Medicinal Plant name	Chalcone	Reference no.
Dydimocarpus aurentica	Aurentiacin A and Aurentiacin B	Adhitya chaudhury [12], 1976
Pityrogramma triangularis	Triangularin-2′,6′-dihydroxy-4′-methoxy-3′-methylchalcone	Star [13] 1978
Myrica gale	2′,6′-dihydroxy-4′-methoxy-3′,5′-dimethyldihydrochalcone	Uyar [14], 1978
Derris robusta	Rubone	Chibber [15], 1979
Psoralea corylifolia	*Bakuchalcone*	Suri [16], 1980
Polygonum lapathifolium	dihydrochalcone and three chalcone derivatives lapathinol, lapathone	Ahmad [17], 1981
Brackenridgea zanguebarica	Brackenin	Drewes [18], 1983
Tephrosia woodii	Mixtecacin	Dominguez [19], 1983
Helichrysum rugulosum	Mixture of 1,3,4- trimethoxy derivatives and dimethyl allyl groups and methoxy derivatives chalcone	Bohlmann [20], 1984
Lindera umbellate	2′,6′-dihydroxy-4′-methoxydihydrochalcone and 2,4′,6′-trihydroxydihydrochalcone	Tanaka [21], 1984
Glycyrrhizae radix	Isoliquiritin and Licuraside	Aida [22], 1990
Angelica keiskei	Xanthangelols B-E	Baba [23], 1990
Bidens tripartitus	2'-hydroxy-4, 4'-dimethoxychalcone	Christensen [24], 1990
Pongamia pinnata	Ponganones I and II	Tanaka [25], 1991
Dalbergia stipulacea	Stipulin	Bhatt [26], 1992
Primula macrophylla	3,3'-dihydroxychalcone	Ahmad [27], 1992
Tephrosia spinosa	Spinochalcones A and B, flemistrictinA	Venkata Rao [28], 1992
Calythropsis aurea	Calythropsin and dihydrocalythropsin	Beutler [29], 1993
Boronia inconspicua	2',4,4',6'-tetrahydroxy-5-(E-3,7-dimethylocta-2,6-	Ahsan [30], 1994

	dienyl)-3-(3-methylbut-2-enyl) dihydrochalcone and 2',4,4',6'- tetrahydroxy-3,5-di(3-methylbut-2-enyl) dihydrochalcone	
Fissistigma lanuginosum	Pedicin, fissistin and isofissistin	Alias [31], 1995
Syzygium samarangense	4′,6′-dihydroxy-2′-methoxy-3′,5′-dimethyl chalcone	Srivastava [32], 1995
Crotalaria trifoliastrum	Munchiwarin	Yang [33], 1998
Pancratium maritimum L.	Isoliquiritigenin	Youssef [34], 1998
Millettia usaramensis	α,4,2′-trihydroxy-4′-O-geranyldihydrochalcone	Yenesew [35], 1998
Uvaria dulcis	2',3'-Dihydroxy-4'6'-dimethoxchalcone	Chantrapromma [36], 2000
Dorstenia prorepens	Prorepensin	Abegaz [37], 2002
Dorstenia zenkeri	p-hydroxybenzaldehyde, dorsmanin A, 4,2,4-trihydroxychalcone and 4,2,4-trihydroxy-3-prenylchalcone	Abegaz [37], 2002
Boesenbergia pandurate	L-hydroxypanduratin A, panduratin A, sakuranetin, pinostrobin, pinocembrin and dihydro-5,6-dehydrokawain	Tuchinda [38], 2002
Artocarpus bracteata	Artoindonesianin J	Ersam [39], 2002
Lonchocarpus sericeus	Lonchocarpin and derricin	Andrade Cunha [40], 2003
Angelica keiskei	Xanthoangelol, isobavachalcone, Xanthoangelol H, laserpitin, isolaserpitin, 3'-senecioyl khellacone, 4'-senecioyl khellactone, selinidin	Akihisa [41], 2003
Lithocarpus pachyphyllus	Three sweet dihydrochalcone glucosides tribatin 2''-acetate, phloridzin and trilobatin	Yang [42], 2004
Mallotus philippinensis	Mallotophilippens C, D and E	Daikonya [43], 2004
Beilschmiedia tovarensis	2′,6′-dihydroxy-4-isopenteniloxy-3,4-(3″,3″-dimethylpyrano) chalcone and 4,2′,6′-trihydroxy-3′,4′-metilenodioxo-3-isopentenilchalcone	Suarez [44], 2005
Bauhinia variegate	2′-hydroxy-4′,6′-dimethoxy-3,4-methylenedioxy chalcone	Maheswara [45], 2006
Cryptocarya costata	2',4'-dihydroxy-5'6'-dimethoxychalcone	Usman [46], 2006
Angelica keiskei	Xanthokeismins A, B and C	Aoki [47], 2008
Garcinia indica Choisy	Garcinol	Panhey [48], 2009
Lonchocarpus xuul	Isocordoin and 2', 4'-dihydroxy-3'-(dimethylallyl)-dihydrochalcone	Borges-Argaez [49], 2009
Bacopa monnierie	2,4,6-trihydroxy-5-(3,3-dimethyl propenyl)-3-(4-hydroxyphenyl) propiophenone	Suresh [50], 2010
Mora alba L.	Morachalcones B and C	Yang [51], 2010
Desmos cochinchinensis	Desmosflavans A and B	Bajgai [52], 2011
Glycyrrhiza inflata	Licochalcone G, licochalcone A, echinantin, 5-prenylbutein, licochalcone D, isoliquiritigenin, licoagrochalcone A and kanzonol C	Dao [53], 2011
Entada phaseoloides	4'-O-(6''-O-galloyl-β-d-glucopyranosyl)- 2',4-dihydroxychalcone, 4'-O-(6''-O-galloyl-β-d-glucopyranosyl)- 2'-hydroxy-4-methoxychalcone and 4'-O-β-d-glucopyranosyl-2'-hydroxy-4-methoxychalcone	Zhao [54], 2011
Erythrina mildbraedii	Mildbenone	Ali [55], 2012
Millettia pachycarpa	4-methoxylonchocarpin, isobavachromene and dorspoinsettifolin	Su [56], 2012
Trigonosciadium brachytaenium	Trans-2'6'-dihydroxy-4'-O-(4''-acetyl-rhamnoside)-4-methoxychalcone	Akhavan [57], 2013
Oxytropis falcata	2',4'-dihydroxychalcone, 2',4',4-trihydroxychalcone, 2'-hydroxy-4'-methoxychalcone and 2',4'-dihydroxy-4-methoxychalcone	Zhang [58], 2013
Fissistigma bacteolatum	Bractelactone	Wu [59], 2013
Nardostachys chinensis	Nardokanshone A Diprenylated	Wang [60], 2013
Artocarpus elasticus	dihydrochalcones, Elastichalcone A1 and Elastichalcone B2	Ramli [61], 2013
Coreopsis lanceolate	3,2'-dihydroxy-4,3'-dimethoxychalcone-4'-glucoside, 4'-O-(2'''-O-caffeoyl)-2',3',3,4-	Shang [62], 2013

	tetrahydroxychalcone and 2',4',3-trihydroxy-3',4-dimethoxychalcone	
Lophira alata	Lophirone B and C	Ajiboye [63], 2014
Humulus lupulus	Xanthohumol-M, bichalcone humulusol and six known chalcones	Yu [64], 2014
Helicrysum zivojinii	Bis-dihydrochalcone	Aljancic [65], 2014
Piper aduncum L.	Cardamonin	Castro [66], 2015
Eysenhardtia polystachya	2′,4′-dihydroxychalcone-6′-O-β-D-glucopyranoside, α,3,2′,4′-tetrahydroxy-4-methoxy-dihydrochalcone-3′,-C-β-glucopyranosy-6′-O-β-D-glucopyranoside and α,4,4′-trihydroxydihydrochalcone-2′-O-β-D-glucopyranoside	Perez-Gutierrez [67], 2016
Haematoxylum campechianum L.	Sappanchalcone and 3-deoxysappanchalcone	Escobar-Ramos [68], 2017
Finger root	Two chalcone derivatives	Brahimawad [69], 2018
Persicaria lapathifolia	Flavokawain B, pinostrobin and pashanone chalcones	Hailemariam [70], 2018

Importance of Chalcones: An interesting feature of chalcones pharmacophore is that they serve as starting materials for the synthesis of five and six-membered heterocyclic compounds such as Pyrimidines, Pyrazolines, Flavones, Flavonols, Flavonones, Aurones and Benzoylcoumarones as well as certain compounds like Deoxybenzoins and Hydantoins which are of some therapeutic application [71]. Chalcones and their derivatives find application as artificial sweeteners, scintillators, polymerization catalysts, fluorescent whitening agents, organic brightening agents, stabilizers against heat, visible light, ultraviolet light and aging [8]. Chalcone containing plants have also been used for a long time in traditional medical practice. The use of herbal medicines continues to expand rapidly across the world. As a result of pharmacological studies, several pure chalcones isolated from different plants have been approved for clinical trials for treatment of cancer, viral and cardiovascular disorders or have been included as ingredients in cosmetic preparations [72, 73]. Polyphenols represent one of the most prevalent classes of compounds found in our daily diet. Over the last ten years, increasing attention has been dedicated to chalcones because of their interesting biological activities. Indeed, chalcones constitute an important group of natural compounds that are especially abundant in fruits (*e.g.*, citruses, apples), vegetables (*e.g.*, tomatoes, shallots, bean sprouts, potatoes) and various plants and spices (*e.g.*, licorice), many of which have been used for centuries in traditional herbal medicine. The majority of the content of chalcones in citrus fruits and various plants is mediated through the formation of 4,2′,4′,6′-tetrahydroxychalcone (also known as naringenin chalcone by chalcone synthase. Naringenin chalcone also plays an essential role in the flavonoid biosynthetic pathway and contributes significantly to the total amount of plant flavonoids [74].

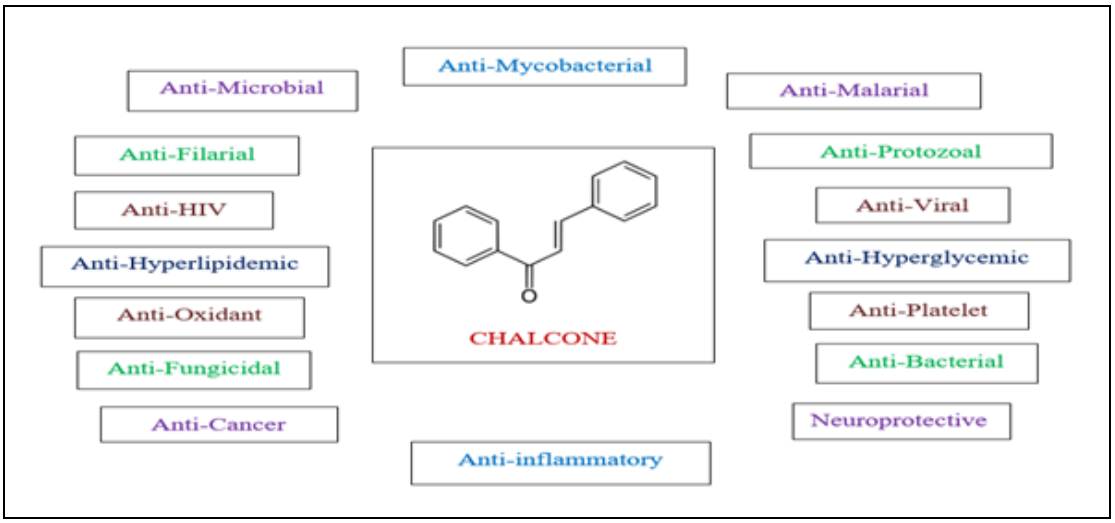


FIG. 3: PHARMACOLOGICAL ACTIVITIES OF CHALCONE

Pharmacological Activities of Chalcones: The biological effects of chalcones were found to be dependent on the presence, the number and position of functional groups such as methoxy, glycosides, hydroxyl, halogens in both A and B rings [75]. They present a broad spectrum of biological activities such as antifungal [76], antifilarial, larvicidal, anticonvulsant [66], anticancer [77, 78], anti-inflammatory [79], neuroprotective [79], antimalarial [80], antibacterial [81], antilipidemic [82], antihyperglycemic [82], antiviral [83], antimycobacterial [84], antiprotozoal (antileishmanial and antitrypanosoma) [85], antiangiogenic [86], antiplatelet [87], anti-HIV [88] and Two chalconoids from the desert plant *Pulicaria incisa* prevented cell death by inhibiting reactive oxygen species (ROS) [89]. The chalcones showed selective, reversible and potent MAO-B inhibition compared to MAO-A. Recent studies also showed that heteroaryl-based chalcones are potent MAO-A inhibitors [90].

CONCLUSION: Chalcones are a common scaffold found in many naturally occurring compounds, especially plant-derived natural products. In addition, many chalcone derivatives are prepared due to their easy convenience for synthesis. Chalcone is regarded as a privileged structure of great practical interests because these natural and synthetic chalcone derivatives have shown numerous interesting biological activities with clinical potential against various diseases. Chalcones attracted considerable research interest in multiple disciplines [91].

ACKNOWLEDGEMENT: Financial support provided by the DST-SERB, New Delhi under the Empowerment and Equity opportunities for Excellence in Science is gratefully acknowledged.

CONFLICTS OF INTEREST: The authors confirm that this article content has no conflicts of interest.

REFERENCES:

1. Phan CW, Sabaratnam V, Yong WK and Abd Malek SN: The role of chalcones: helichrysetin, xanthohumol and flavokawin-C in promoting neurite outgrowth in PC12 ADH cells. Nat Prod Res 2018; 32(10): 1229-33.
2. Zhang J, Ji FJ, Gu Y, Zhang XY and Qiao SX: Chalcones derivatives as potent cell division cycle 25B phosphatase inhibitors. Pharmacol Rep 2014; 66(3): 515-9.
3. Rozmer Z and Perjesi P: Naturally occurring chalcones and their biological activities. Phyto 2016; 15(1): 87-120.
4. Batovska DI and Todorova IT: Trends in utilization of the pharmacological potential of chalcones. Curr Clin Pharmacol 2010; 5(1): 1-29.
5. Panche AN, Diwan AD and Chandra SR: Flavonoids: an overview. Journal of Nutritional Sciences 2016; 5(47): 1-15.
6. Katsori AM and Litina HD: Recent progress in therapeutic applications of chalcones. Expert Opinion on Therapeutic Patents 2011; 21(10): 1575-96.
7. Sahu NK, Balbhadra SS, Choudary J and Kohli DV: Exploring the pharmacological significance of chalcone scaffold: a review. Curr Med Chem 2012; 19(2): 209-25.
8. Yerragunta V, Kumaraswamy T, Suman D, Anusha V, Patil P and Samhitha T: A review on chalcones and its importance Pharma Tutor 2013; 1(2): 54-9.
9. Chavan BB, Gadekar AS, Mehta PP, Vawhal PK, Kolsure AK and Chabukswar AR: Synthesis and medicinal significance of chalcones- a review. Asian Journal of Biomedical and Pharmaceutical Sci 2016; 6(56): 01-07.
10. Shailendra M, Hemendra PS, Dutta SG and Moorthy NSHN: Synthesis and characterization of some chalcone derivatives. Trends in Applied Sci Res 2007; 2(1): 52-6.
11. Diaz-Tielas C, Grana E, Reigosa MJ and Moreiras SAM: Biological activities and novel applications of chalcones. Planta Daninha 2016; 34(3): 607-16.
12. Adityachaudhhury N, Das AK, Choudhaury A and Daskanungo PL: Aurentiacin, a new chalcone from *Dydimocarpus aurentiaca*. Phytochem 1976; 15: 229-30.
13. Star AE, Mabry TJ and Smith DM: Triangularin a new chalcone from *P. triangularis*. Phytoche 1978; 17: 586-87.
14. Uyar T, Malterud KE and Anthonsen T: Two new dihydrochalcones from *Myrica gale*. Phytochemistry 1978; 17: 2011-13.
15. Chibber SS, Sharma RP and Dutt SK: Rubone, a new chalcone from *Derris robusta* seed shells. Phytochemistry 1979; 18: 2056.
16. Suri JL, Gupta GK, Dhar KL and Atal CK: A new chalcone from the seeds of *Psoralea corylifolia*. Phytochemistry 1980; 19: 336-7.
17. Ahmad M, Khaleduzzaman M and Rashid M: Chalcone derivatives from *P. lapathifolium*. Phyto 1981; 20: 2503-6.
18. Drewes SE and Hudson NA: Brackenin, a dimeric dihydrochalcone from *Brackenridgea zanguebarica*. Phytochemistry 1983; 22: 2823-25.
19. Dominguez XA, Tellez O and Ramirez EG: Mixtecacin, a prenylated flavanone and oaxacacin its chalcone from the roots of *Tephrosia woodii*. Phytochemistry 1983; 22: 2047-9.
20. Bohlmann F and Misra LN: New prenylflavanones and chalcones from *Helichrysum rugulosum*. Planta Med 1984; 50: 271-2.
21. Tanaka H, Ichino K and Ito K: Dihydrochalcones from *Lindera umbellate*. Phytochemistry 1984; 23: 1198-9.
22. Aida K, Tawata M, Shindo H, Onaya T, Sasaki H, Yamaguchi T, Chin M and Mitsuhashi H: Isoliquiritigenin: a new aldose reductase inhibitor from *Glycyrrhizae radix*. Planta Med 1990; 56: 254-8.
23. Baba K, Nakata K, Taniguchi M, Kido T and Kozawa M: Chalcones from *Angelica keiskei*. Phytochemistry 1990; 29: 3907-10.
24. Christensen LP, Lam J and Thomasen T: A chalcone and other constituents of *Bidens tripartitus*. Phytochemistry 1990; 29: 3155-6.
25. Tanaka T, Linuma M, Yuki K, Fujii Y and Mizuno M: Two new beta-hydroxychalcones from the root bark of *Pongamia pinnata*. Chem Pharm Bull 1991; 39: 1473-5.

26. Bhatt P and Dayal R: Stipulin, a prenylated chalcone from *Dalbergia stipulacea*. Phytochemistry 1992; 31: 719-21.
27. Ahmad VU, Shah MG, Noorwala M and Mohammad FV: Isolation of 3,3'-dihydroxychalcone from *Primula macrophylla*. J Nat Prod 1992; 55: 956-8.
28. Rao EV and Prasad YR: Two chalcones from *Tephrosia spinosa*. Phytochemistry 1992; 31: 2121-2.
29. Beutler JA, Cardellina JH, Gray GN, Prather TR, Shoemaker RH and Boyd MR: Two new cytotoxic chalcones from *C. aurea*. J Nat Prod 1993; 56: 1718-22.
30. Ahsan M, Armstrong JA and Waterman PG: Dihydrochalcones from the aerial parts of *Boronia inconspicua*. Phytochemistry 1994; 36: 799-01.
31. Alias Y, Awang K, Hadi AHA, Thoison O and Sevenet T: An antimitotic and cytotoxic chalcone from *Fissistigma lanuginosum*. J Nat Prod 1995; 58: 1160-6.
32. Srivastava R, Shaw AK and Kulshreshtha DK: Triterpenoids and chalcone from *Syzygium samarangense*. Phytochemistry 1995; 38: 687-9.
33. Yang SW, Cordell GA, Lotter H, Wagner H, Mouly BC, Rao AVNA and Rao PS: Munchiwarin, a prenylated chalcone from *Crotalaria trifoliastrum*. J Nat Prod 1998; 61: 1274-6.
34. Youssef DTA, Ramadan MA and Khalifa AA: Acetophenones, a chalcone, a chromone and flavonoids from *P. maritimum*. Phytochemistry 1998; 49(8): 2579-83.
35. Yenesew A, Midiwo JO and Waterman PG: Rotenoids, isoflavones and chalcones from the stem bark of *Millettia usaramensis* subspecies usaramensis. Phytochemistry 1998; 47: 295-300.
36. Chantrapromma K, Ratapa Y, Karalai C, Lojanapiwatana V and Seechamnanturakit V: A chalcone and a dihydrochalcone from *U. dulcis*. Phytochemistry 2000; 53: 511-3.
37. Abegaz BM, Ngadjui BT, Dongo E, Ngameni B, Nindi MN and Bezabih M: Chalcones and other constituents of *Dorstenia prorepens* and *Dorstenia zenkeri*. Phytochemistry 2002; 59: 877-83.
38. Tuchinda P, Reutrakul V, Claeson P, Pongprayoon U, Sematong T, Santisuk T and Taylord WC: Anti-inflammatory cyclohexenyl chalcone derivatives in *Boesenbergia pandurate*. Phytochemistry 2002; 59: 169-73.
39. Ersam T, Achmad SA, Ghisalberti EL, Hakim EH, Makmur L and Syah YM: A new isoprenylated chalcone, artonoidonesianin J, from the root and tree bark of *Artocarpus bracteate*. J Chem Res 2002; 186-7.
40. Andrade Cunha GM, Fontenele JB, Nobre HV, Sousa FCM, Silveira ER, Nogueira NAP, Mpraes MO, Viana GSB and Costa-Lotufo LV: Cytotoxic activity of chalcones isolated from *Lonchocarpus sericeus*. Phytother Res 2003; 17(2): 155-9.
41. Akihisa T,Tokuda H, Ukiya M, Iizuka M, Schneider S, Ogasawara K, Mukainaka T, Iwatsuki K, Suzuki T and Nishino H: Chalcones, coumarins and flavanones from the exudate of *Angelica keiskei* and their chemopreventive effects. Cancer Lett 2003; 201: 133-7.
42. Yang WM, Liu JK, Qin XD, Wu WL and Chen ZH: Antioxidant activities of three dihydrochalcone glucosides from leaves of *Lithocarpus pachyphyllus*. Z Naturforsch 2004; 59: 481-4.
43. Daikonya A, Katsuki S and Kitanaka S: Antiallergic agents from natural sources 9. Inhibition of nitric oxide production by novel chalcone derivatives from *Mallotus philippinensis* (Euphorbiaceae). Chem Pharm Bul 2004; 52: 1326-9.
44. Suarez LEC and Vargas OEB: New chalcones from *Beilschmiedia tovarensis*. Rev Col Quim 2005; 34: 35-41.
45. Maheswara, Koteswara Rao Y, Siddaiah V and Venkata Rao C: Isolation of new chalcone from the leaves of *Bauhinia variegata*. Asian Journal of Chemistry 2006; 18(1): 419-2.
46. Usman H, Hakim EH, Harlim T, Jalaluddin MN, Syah YM, Achmad SA and Takayama H: Cytotoxic chalcones and flavanones from the tree bark of *Cryptocarya costata*. Z Naturforsch 2006; 6:184-8.
47. Aoki N, Muko M, Ohta E and Ohta S: C-gernylated chalcones from the stems of *Angelica keiskei* with superoxide scavenging activity. J Nat Prod 2008; 71: 1308-10.
48. Panhey S, Ahmad A, Oswal N and Sarkar FH: Emerging role of Garcinol, the antioxidant chalcone from *Garcinia indica* Choisy and its synthetic analogs. Journal of Hematology & Oncology 2009; 2(1): 1-13.
49. Borges-Argaez R, Vela-Catzin T, Yam-Puc A and Chan M: Antiprotozoal and cytotoxic studies on isocordoin derivatives. Planta Medica 2009; 75(12): 1336-8.
50. Suresh A, Sheela X, Kanmani R, Mani C, Easwaran L, Stanley AL and Ramani VA: Isolation and identification of a chalcone from *Baccopa monnieri*. Asian J Chem 2010; 22: 965-70.
51. Yang Y, Zhang T, Xiao L, Yang L and Chen R: Two new chalcones from leaves of *Morus alba* L. Fitoterapia 2010; 81: 614-16.
52. Bajgai SP, Prachyawarakorn V, Mahidol C, Ruchirawat S and Kittakoop P: Hybrid flavanchalcones, aromatase and lipoxygenase inhibitors from *Desmos cochinchinensis*. Phytochemistry 2011; 72: 2062-7.
53. Dao TT, Nguyen PH, Lee HS, Kim E, Park J, Lim SI and Oh WK: Chalcones as novel influenza A (H1N1) neuraminidase inhibitors from *Glycyrrhiza inflata*. Bioorg Med Chem Lett 2011; 21: 294-8.
54. Zhao Z, Jin J, Lin C, Zhu C, Liu Y, Lin A, Zhang L and Luo H: Two new chalcone glycosides from the stem bark of *Entada phaseoloides*. Fitoterapia 2011; 82: 1102-5.
55. Ali MS, Ali MI, Ahmed G, Afza N, Lateef M, Iqbal L, Waffo AFK and Ahmed Z: Potent antioxidant and lipoxygenase inhibitory flavanone and chalcone from *Erythrina mildbraedii* Harms of Cameroon. Z Naturforsch B 2012; 67: 98-102.
56. Su XH, Li CY, Zhong YJ, Yuan ZP, Li YF and Liang B: A new prenylated chalcone from the seeds of *Millettia pachycarpa*. Chin J Nat Med 2012; 10: 222-5.
57. Akhavan M, Shafaghat A and Salimi F: Novel acetylated chalcone and biflavonoid glycosides from *Trigonosciadium brachytaenium* (Boiss.) Alava. Nat Prod Res 2013; 22: 2111-7.
58. Zhang XJ, Li LY, Wang SS, Que S, Yang WZ, Zhang FY, Gong NB, Cheng W, Liang H, Ye M, Jia YX and Zhang QY: Oxyfadichalcones A-C: three chalcone dimers fused through a cyclobutene ring from Tibetan medicine *Oxytropis falcata* Bunge. Tetrahedron 2013; 69: 11074-9.
59. Wu YC, Sureshbabu M, Fang YC, Wu YH, LanYH, Chang FR, Chang YW and Hwang TL: Potent inhibition of human neutrophil activations by bractelactone a novel chalcone from *Fissistigma bracteolatum*. Toxicol Appl Pharmacol 2013; 266: 399-07.
60. Wang PC, Ran XH, Luo HR, Zheng YM, Liu YQ, Hu JM and Zhou J: Nardokanshone A, a new type of sesquieterpenoid-chalcone hybrid from *Nardostachys chinesis*. Tetrahedron Lett 2013; 54: 5650.
61. Ramli F, Rahmani M, Kassim NK, Hashim NM, Sukari MA, Akim AM and Go R: New diprenylated dihydrochalcones from leaves of *Artocarpus elasticus*. Phytochem Lett 2013; 6: 582-5.

62. Shang YF, Oidovsambuu S, Jeon JS, Nho CW and Um BH: Chalcones from the flowers of *Coreopsis lanceolata* and their *in-vitro* antioxidant activity. Planta Med 2013; 79(4): 295-00.
63. Ajiboye TO, Yakubu MT and Oladiji AT: Cytotoxic, antimutagenic and antioxidant activities of methanolic extract and chalcone dimers (Lophirone B and C) derived from *Lophira alata* (Van Tiegh. Ex Keay) stem bark. Evid Based Complement Alternat Med 2014; 19: 20-30.
64. Yu L, Zhang F, Hu Z, Ding H, Tang H, Ma Z and Zhao X: Novel prenylated bichalcone and chalcone from *Humulus lupulus* and their quinone reductase induction activities. Fitoterapia 2014; 93: 115-20.
65. Aljancic IS, Vuckovic I, Jadranin M, Pesic M, Dordevic I, Podolski-Renic A, Menkovic N, Vajs VE and Milosavljevic SM: Two structurally distinct chalcone dimers from *Helichrysum zivojinii* and their activities in cancer cell lines. Phytochemistry 2014; 98: 190-6.
66. Castro CC, Costa PS, Laktin GT, de Carvalho PH, Geraldo RB, de Moraes J, Pinto PL, Couri MR, Pinto Pde F and Da Silva Filho AA: Cardamonin, a schistosomicidal chalcone from *Piper aduncum* L. (Piperaceae) that inhibits Schistosoma mansoni ATP diphosphohydrolase. Phytomedicine 2015; 22(10): 921-8.
67. Perez-Gutierrez RM, Garcia-Campoy AH and Muniz-Ramirez A: Properties of flavonoids isolated from the bark of *Eysenhardtia polystachya* and their effect on oxidative stress in streptozotocin-induced Diabetes Mellitus in mice. Oxidative medicine and cellular longevity 2016; 1-13.
68. Escobar-Ramos A, Lobato-Garcia CE, Alejandro Zamilpa ID, Gomez-Rivera A, Tortoriello J and Gonzalez-Cortazar M: Homoisoflavonoids and chalcones isolated from *Haematoxylum campechianum* L., with spasmolytic activity. Molecules 2017; 22: 1-10.
69. Brahimawad M, Abdullah HD, Nadeem AM and Hamid H: Characterization of two chalcone derivatives isolated from Finger root with nutraceutical potentials. Int Journal of Advanced Research 2018; 6(11): 1089-94.
70. Hailemariam A, Feyera M, Deyou T and Abdissa N: Antimicrobial chalcones from the seeds of *Persicaria lapathifolia*. Biochem Pharmacol 2018; 7(1): 1-4.
71. http://www.knigozal.com/gb/search.xml?q=Chalcones.
72. Gomes M, Muratov E, Pereira M, Peixoto J, Rosseto L, Cravo P and Neves B: Chalcone derivatives: promising starting points for drug design. Molecules 2017; 1-25.
73. Ni L, Meng CQ and Sikorski JA. Recent advances in therapeutic chalcones. Expert Opinion on Therapeutic Patents 2004; 14(12): 1669-91.
74. Orlikova B, Tasdemir D, Golais F, Dicato M and Diederich M. Dietary chalcones with chemopreventive and chemotherapeutic potential. Genes Nut 2011; 6(2): 125-47.
75. Gutierrez RMP, Ramirez AM and Sauceda JV: Review: The potential of chalcones as a source of drugs. Afr J Pharm Pharmacol 2015; 9(8): 237-57.
76. Elsohly HN, Joshi AS, Nimrod AC, Walker LA and Clark AM: Antifungal chalcones from *Maclura tinctorial*. Planta Med 2001; 67: 87-9.
77. Zhang YY, Huang CT, Liu SM, Wang B, Guo J and Bai JQ: Licochalcone A exerts antitumor activity in bladder cancer cell lines and mice models. Trop J Pharm Res 2016; 15(6): 1151-7.
78. Yagura T, Motomiya T, Ito M, Honda G, Lida A, Kiuchi F, Tokuda H and Nishino H. Anticarcinogenic compound in the Uzbek medicinal plant, *Helichrysum maracandicum*. J Nat Med 2008; 62: 174-8.
79. Jiwrajka M, Phillips A, Butler M, Rossi M and Jennifer MP: The plant derived chalcone 2,2′,5′-Trihydroxychalcone provides neuroprotection against toll-like receptor 4 triggered inflammation in microglia. Oxidative medicine and cellular longevity 2016; 1-10.
80. Portet B, Fabre N, Roumy V, Gornitzka H, Bourdy G, Chevalley S, Sauvain M, Valentin A and Moulis C: Activity-guided isolation of antiplasmodial dihydro-chalcones and flavanones from Piper hostmannianum var. berbicense. Phytochemistry 2007; 68: 1312-20.
81. Koudokpon H, Armstrong N, Dougnon TV, Fah L, Hounsa E, Bankole HS, Loko F, Chabriere E and Rolain JM: Antibacterial activity of chalcone and dihydrochalcone compounds from *Uvaria chamae* roots against multidrug resistant bacteria. Biomed Res International 2018; 1-10.
82. Sun H, Wang D, Song X, Zhang Y, Ding W, Peng X, Zhang X, Li Y, Ma Y, Wang R and Yu P: Natural prenylchalconaringenins and α-amylase inhibition and *in-vivo* antihyperglycemic and antihyperlipidemic effects. J Agric Food Chem 2017; 65(8): 1574-81.
83. Onylagha JC, Malhotra B, Elder M, French CJ and Towers GHN: Comparative studies of inhibitory activities of chalcones on tomato ringspot virus (ToRSV). Canadian journal of plant pathology 1997; 19(2): 133-7.
84. Friis-Moller A, Chen M, Fursted K, Christensen SB and Kharazmi A: *In-vitro* antimycobacterial and antilegionella activity of Licochalcone A from Chinese Licorice roots. Planta Medica 2002; 68(5): 416-9.
85. Kayser O and Kiderlen AH: *In-vitro* Leishmanicidal activity of naturally occuring chalcones. Phytotherapy Research 2001; 15(2): 148-52.
86. Bertl E, Becker H, Eicher T, Herhaus C, Kapadia G, Bartsch H and Gerhauser C: Inhibition of endothelial cell functions by novel potential cancer chemopreventive agents. Biochem Biophys Res Commu 2004; 3(1): 287-95.
87. Fontenele JB, Leal LKAM, Ferreira MAD, Viana GSB and Silveira ER: Antiplatelet effect of lonchocarpin and derricin isolated from *Lonchocarpus sericeus*. Pharm Biol 2005; 43: 726-31.
88. Wu JH, Wang XH, Yi YH and Lee KH: Anti-AIDS agents 54, A potent anti-HIV chalcone and flavonoids from genus Desmos. Bioorg Med Chem Lett 2003; 13: 1813-15.
89. Elmann A, Telerman A, Erlank H, Mordechay S, Rindner M, Rivka O and Kashman Y: Protective and antioxidant effects of a chalconoid from *Pulicaria incisa* on brain astrocytes. Oxid Med Cell Longey 2013; 1-10.
90. Mathew B, Haridas A, Suresh J, Mathew EG, Ucar G and Jayaprakash V: Monoamine oxidase inhibitory action of chalcones: A mini review. Central Nervous System Agents in Medicinal Chemistry 2016; 16(2): 120-36.
91. Zhuang C, Zhang W, Sheng C, Zhang W, Xing C and Miao Z: Chalcone: A privileged structure in medicinal chemistry. Chemical Reviews 2017; 117(12): 7762-10.

How to cite this article:
Banoth RK and Thatikonda A: A review on natural chalcones an update. Int J Pharm Sci & Res 2020; 11(2): 546-55. doi: 10.13040/IJPSR. 0975-8232.11(2).546-55.