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Original Article

Novel Substituted-dene-2-(-1,3-Diphenylallylidene) Hydrazine: Design, Synthesis, and *in vitro* Microbial Assessment

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ABSTRACT

Background: The production of a variety of chalcones (1-Aryl/Alkyl amino substituted-dene-2-(-1,3-diphenylallylidene) hydrazine (ABSa-e) was brought about as a result of the condensation of hydrazide compound and Aryl/Alkyl substituted aldehyde/ ketone in ethanol as a solvent with the help of two drops of conc. hydrochloric acid as a catalyst followed by neutralization. All synthesized derivatives were identified with different spectroscopic techniques and biologically evaluated by microorganisms. **Materials and Methods:** The *in vitro* antibacterial and antifungal activity of all synthesised compounds was evaluated. In the microbial studies, the five strains of selected bacteria and two strains of fungi have been used to evaluate the synthesized compounds, DMSO used as the solvent, and amoxicillin and griseofulvin used as control drugs. **Results and Conclusion:** Derivatives exhibited the highest potency (17mm, 18mm, 16mm, 18mm, 15mm) (MIC) with the electron donating groups (CH_3) in position 4 of the phenyl ring (ABSc). On the other hand, the withdrawing group (NO_2, Cl) of compounds ABSb & ABSe showed the most negligible potency against selected microorganisms. The unsubstituted phenyl ring (ABSa) showed moderate activity (17mm, 15mm, 15mm, 16mm, 14mm) at 100 µg/mL. The oxygen-containing furan compound ABSd proved as the second-highest potency (16mm, 17mm, 15mm, 17mm, 14mm) of this series. All of the results pointed to compound ABSc as a potential antibacterial lead molecule, and efforts are currently being made to increase the potency of amino chalcone derivatives.

Keywords: Chalcone, Aldehyde, Antibacterial, Antifungal, Potency.

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INTRODUCTION

A three-carbon, unsaturated oxidative process forms chalcone from two aromatic rings. Open-chain flavonoids. Medicinal chemists are interested in chalcone derivatives because they can be used to make effective medications[1,2] as well as because of a number of intriguing biological roles. Numerous mini-reviews have been published, and chalcones have been thoroughly explored.[3] Synthetic chalcones exhibit an extensive range of bioactivities,[4] including limited to anticancer,[5] anti-inflammatory,[6] antimalarial,[7] antibacterial,[8] antifungal[9,10] antimicrobial,[11,12] antiprotozoal,[13] anticonvulsant,[14] and antiulcer[15] activities. Metochalcone and sofalcone,[16] it has been approved for clinical testing of two chalcones produced from plant products as anticancer and antiulcer drugs. Amino chalcones with -NR_2 groups on rings A or B is important (Figure 1).

Recently, several groups have synthesised these molecules and assessed their biological importance. The deadly effect of aldehyde-condensed chalcones has come to light due to the possibility of a covalent bond resulting from hetero-Michael addition-enhanced electrophilic assault on biological proteins. The derivatives of chalcones may serve as starting points for the development of inhibitors that specifically target particular biological proteins. The study of covalent inhibitors is a new field in medication development. In order to identify a common structural determination, we conducted a review of the bibliographic reports of simple chalcones having antibacterial activity. Chalcones are a suitable scaffold for the creation of novel derivatives because only synthetic chalcones have been

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documented in relation to these pathogeneses. A three-carbon, unsaturated oxidative process forms chalcones from two aromatic rings. Open-chain flavonoids. Medicinal chemists are interested in chalcone derivatives because they can be used to make effective medications. As a result, the article provides information on the diverse biological functions of chalcones and their connection to structure.[17,18]

MATERIALS AND METHODS

Chemical

The uncorrected melting points (mp) were calculated using the Thomas Hoover apparatus. A Perkin-Elmer 398 spectrometer was used to record the IR spectra on film or on discs made of potassium bromide. A three-carbon, unsaturated oxidative process forms chalcones from two aromatic rings. Open-chain flavonoids. Medicinal chemists are interested in chalcone derivatives because they can be used to make effective medications.

Synthesis of Substituted Chalcone (3)

In order to keep the temperature below 20°C, substituted acetophenone (2) (10 mmol) was added dropwise over the course of 45 min to a cool sodium hydroxide solution (5 g) in aqueous ethanol (50 mL, 10%). Next, during the course of 45 min, dropwise addition of the required substituted benzaldehyde (1) (10 mmol) was performed. After 3 hr, the mixture was placed in the refrigerator for the evening. The separated material was then recrystallized from ethanol as a colourless solid after being filtered, water-washed, and dried.

Synthesis of 1-(1,3-Substituted diphenylallylidene) hydrazine[19](4)

For about 6 hr, 10 mmol of hydrazine hydrate in 2 mL of glacial acetic acid was mixed with 10 mmol of chalcones in 10 mL of ethanol. Overnight at room temperature, the outcome combination was dropped on crushed ice. After filtering, the material that had been separated was washed, dried, and put back together with methanol several times. The compound exhibited a yield of 85% and a melting point of 242°C. The calculated percentages for carbon, hydrogen, and nitrogen for the molecular formula $C_{15}H_{14}N_2$ were 81.05%, 6.35%, and 12.60%, respectively. The actual percentages found were C 80.75%, H 6.45%, and N 13.01%. The absorption peaks for C=N were at 2220 cm^{-1} and for NH they were at 3252 cm^{-1}. The ^1H NMR spectrum, recorded at 300 MHz in $CDCl_3$, displayed a singlet at 5.25 ppm for one hydrogen atom, a singlet at 6.60 ppm for one hydrogen atom, a multiplet in the range of 7.21-7.30 ppm for five aromatic hydrogen atoms, a multiplet in the range of 7.29-7.60 ppm for five hydrogen atoms in the benzylidennimin group, and a singlet at 7.00 ppm for two NH_2 hydrogen atoms. m/z 222 [M^+] was the molecular ion peak.

General method for synthesis of 1-Aryl/Alkyl amino substituted-dene-2-(-1,3-diphenylallylidene) hydrazine[20] (ABSa-e)

In 20 mL of pure ethanol, the hydrazide compound 4 (.01 mmol) and its equal amount of Aryl/Alkyl substituted aldehyde/ketone derivative (.02 mmol) were dissolved. A few drops of concentrated hydrochloric acid be added as a catalyst and stirred for between thirty and sixty min at room temperature. The modified diphenylallylidene hydrazine molecules ABSa-e were effectively separated by concentrating the reaction mixture under low pressure and neutralizing it with a 10% solution of sodium bicarbonate in water. This was done after TLC showed that the reaction was done. The resulting precipitate was filtered, cleaned in 10 mL of water, and then crystallized using the right solvent. The title compounds were synthesized the following scheme.

SCHEME

Synthesis of Title Compounds of 1-Substituted-dene-2-(-1,3-diphenylallylidene) hydrazine (ABSa-e).

ABS-a or 1-(1,3-diphenylallylidene)-2-phenylidenehydrazine: Yield: 85%; m.p. 272°C; analytical calculated (%) values for $C_{22}H_{18}N_2$: C, 85.13; H, 5.85; N, 09.03; actual values: C, 90.40; H, 6.75; N, 08.61; IR (cm^{-1}) values: 2220 (C=N), NH (3252); 5.25 and 6.60 (s, 1H, 1-ethylene), 6.60 (s, 1H, 1-ethylene), 7.29-8.11 (m, 11H, benzylidennimin), and 7.14-7.30 (m, 5H, Ar-H); ^1H NMR (300 MHz, $CDCl_3$, ppm); m/z: 310 [M^+] are the ^1H NMR data for $CDCl_3$.

ABS-b or1-(4-Nitrobenzylidene)-2-(1,3-diphenylallylidene) hydrazine: Yield: 80%; m.p. 253°C; calculated values for $C_{22}H_{17}N_3O_2$ were C, 74.35, H, 4.82, N, 11.82, and O, 9.00; actual values were C, 74.15, H, 4.72, N, 12.15, and O, 8.65; IR (cm^{-1}): in 1532 (NO_2); ^1H NMR as a (300 MHz, $CDCl_3$, ppm) values were [M^+].

ABS-c or 1-(4-methylbenzylidene)-2-(1,3-diphenylallylidene) hydrazine: Yield: 82%; m.p. 247°C; IR (cm^{-1}): 2874 (CH_3); Analytical Calculation (%) for $C_{23}H_{20}N_2$: C, 85.15; H, 6.21; N, 8.63; Found: C, 85.47; H, 6.50; N, 8.12; ^1H NMR Spectra (300 MHz, $CDCl_3$, ppm): 5.60 (1H, s), 6.60 (1H, s), 7.30-8.11 (10H, m), 7.14-7.30 (5H, m), 2.35 (1H, s), m/z: 324 [M^+].

ABS-d or 1-(1,3-diphenylallylidene)-2-(furan-2-ylmethylene):Yield: 87%; m.p. 216°C; Anal. Calc. (%) for $C_{20}H_{16}N_2O$: C, 79.98; H, 5.37; N, 9.33; O, 5.33; found: C, 79.68; H, 5.10; N, 10.01; O, 4.85; IR (cm^{-1}): 1150 (furyl); ^1H NMR (300 MHz, $CDCl_3$, ppm).

ABS-e or 1-(4-chlorobenzylidene)-2-(1,3-diphenylallylidene): Anal. Calculation. (%) for $C_{22}H_{17}N_2Cl$: C, 76.63; H, 4.97; Cl, 10.28; N, 8.12; observed: C, 76.12; H, 5.01; Cl, 10.06; N, 8.68;

Yield: 80%; m.p. 222°C; IR (cm^{-1}): 1090 (C-Cl); ^1H NMR as a (300 MHz, $CDCl_3$, ppm): 5.60 (1H, s), 6.60 (1H, s), 7.30-8.10 (10H, benzylidennimin), 7.14-7.30 (5H, Ar-H); m/z: 345 [M^+].

Biological Section

By using the ditch dilution method,[8-12] the antibacterial and antifungal effects of the substances used in the novel's title were investigated. The bacterial strains known as *Pseudomonas aeruginosa* (DSM-50071), *Escherichia coli* (DSM-498), *Klebsella pneumonia* (DSM-681), and *Salmonella typhi* (DSM-554) are being referred and 01 gram positive bacteria, namely *staphylococcus aureus* (DSM-799) at 100 g/mL, antibacterially tested. *Escherichia coli, Pseudomonas aeruginosa, Klebsella pneumonia, Salmonella typhii*, and *Salmonella typhii* were the test organisms in a two-hour culture that was incubated and cultured in a peptone-water medium. As a solvent control, DMSO was utilised, however it did not exhibit an inhibitory zone. The culture medium utilised was Muller-Hilton agar medium. The plates of culture were kept at 37°C for a period of 24 hr. To gauge the antibacterial activity, the inhibitory zone's diameter (mm) was assessed. A control medicine for antibacterial action has been amoxicillin, and a control drug for antifungal activity has been griseofulvin. At the same concentration of 100 g/mL, *A. niger* (ATCC1015) and *C. albicans* (ATCC10231) were subjected to the antifungal activity. Table 1, Figure 2, and Figure 3 present the findings. MIC was determined using ditch dilution. The 100 µg/mL fixed concentrations of the samples were prepared. Based on the level of bacterial growth that could be seen in the broth, the MIC was calculated, and the concentration was recorded and used for antibacterial sensitivity tests.

RESULTS AND DISCUSSION

Chemical

Acetophenone and benzaldehyde under a base-catalyzed condensation process produced chalcon (3). Aryl/Alkyl substituted aldehyde/ketone in ethanol as a solvent, hydrazide compound as a catalyst, and two drops of concentrated hydrochloric acid were used to create the compounds ABSa-e, which were then neutralised with 10% aqueous solution of Na_2CO_3. After the substrates had fully converted, the precipitated crystals were gathered and refined with ethanol.

The ^1H-NMR analysis of the spectra proved that each derivative contained α, β-unsaturated bonds. At δ 7.93, doublets of chalcone's distinctive signals from H-α and H-β appeared. At 1715 cm^{-1}, the IR peaks for C=O may be seen. Substituted diphenylallylidene hydrazine's C=O group IR peaks vanish, and N-N, NH_2, and C=N peaks arise at 1182 cm^{-1}, 3252 cm^{-1}, and 2220 cm^{-1}, correspondingly. On the other hand, benzylidennimin

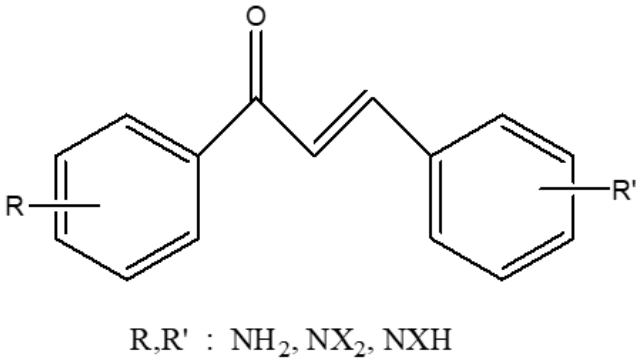

Figure 1: Aminochalcones.

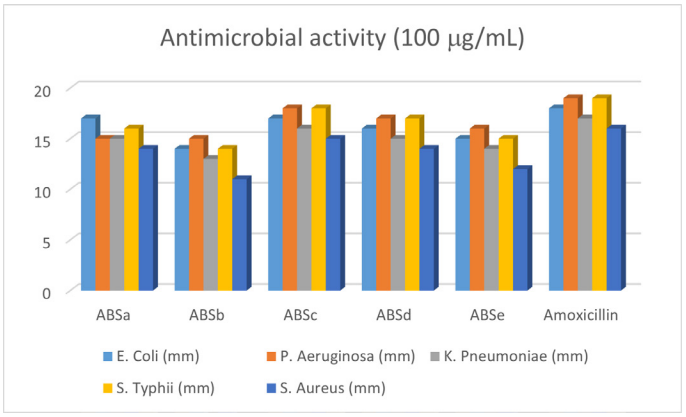

Figure 2: Antibacterial activity (ABSa-e).

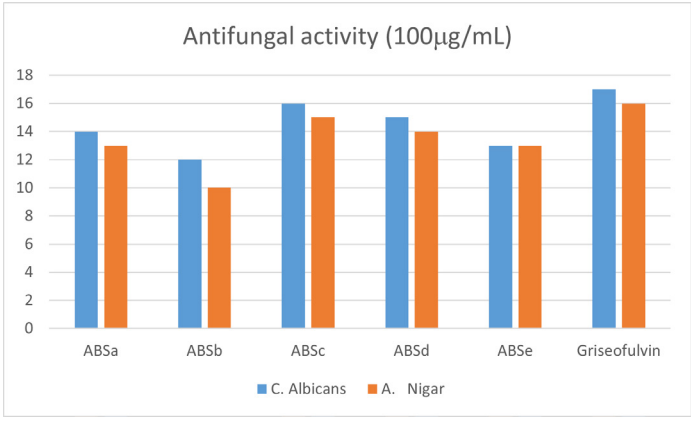

Figure 3: Antifungal activity (ABSa-e).

appears as a multiplet in the δ 7.29-7.60 range and as a singlet for NH_2 at δ 7.0. All of the compounds with the same names have lost their NH_2 peaks, and another C=N peak may be seen between 1660 and 1640 cm^{-1}.

The NO_2, CH_3, C-O-C (furfuryl), and Cl groups all showed peaks in the compound ABSb-e infrared spectra at 1532 cm^{-1}, 2874 cm^{-1}, 1150 cm^{-1}, and 1090 cm^{-1} respectively. The methyl group peaks in the ^1H NMR were clearly visible at δ 2.35 for ABSc, δ 7.50 (C=N), and δ 6.3-7.40 (furan) for ABSd.

Table 1: The results of antimicrobial data of chalcones (ABSa-e).

Compounds	Antibacterial activity (100 µg/mL)						Antifungal activity (100 µg/mL)
	E. coli (mm)	*P. aeruginosa* (mm)	*K. Pneumoniae* (mm)	*S. typhii* (mm)	*S. aureus* (mm)	*C. albicans* (mm)	*Nigar* (mm)
ABSa	17	15	15	16	14	14	13
ABSb	14	15	13	14	11	12	10
ABSc	17	18	16	18	15	16	15
ABSd	16	17	15	17	14	15	14
ABSe	15	16	14	15	12	13	13
Amoxicillin	18	19	17	19	16	-	-
Griseofulvin	-	-	-	-	-	17	16

Biological

Chalcones and heteroaryl chalcones were thought to have antibacterial, antioxidant, and cytotoxic activities, according to studies that were previously published.[21-26] The new substituted chalcones derivatives (ABSa-e) were examined for their antibacterial properties using the ditch dilution method against bacterial and fungal strains based on the aforementioned research (Table 1). The bacterial strains examined included *Salmonella typhii, Klebsella pneumonia, Pseudomonas aeruginosa*, the bacterial strains under consideration are *Staphylococcus aureus*, which is gram-positive, and *Escherichia coli*, which is gram-negative. character and location of aryl ring substituents were key factors of chalcone activity, which had outstanding antibacterial potency (Figures 2 and 3). In compounds ABSb and ABSe, positions 4 on the aryl ring were substituted with CH_3, which gives up an electron, and electron-taking NO_2, Cl.

Unsubstituted phenyl rings are represented by compound ABSa, and furan molecules are represented by compound ABSd. The methyl group at position 4 and the furan compound ABSd in the monosubstituted chalcone derivatives ABSc, as well as the electron-withdrawing (NO_2 and Cl) position at position 4 on the phenyl ring, both shown greater antibacterial and antifungal activity than ABSb and ABSe. This investigation indicated that ABSb and ABSe, which include NO_2 and Cl groups, were less active than amoxicillin and griseofulvin at 100 µg/mL, whereas ABSa, which has an unsubstituted phenyl ring, was mild.

CONCLUSION

In an outer layer, we reported the *in vitro* antimicrobial activity studies of 1-Aryl/Alkyl amino substituted-dene-2-(-1,3-diphenylallylidene) hydrazine (ABSa-e), based on the MIC, some of few tested compounds remained found to be potent against microorganisms and compared with standard amoxicillin and griseofulvin drug at 100 µg/mL and also DMSO used as a solvent. The electronic property (Electron releasing and retreating) of the substituents on the aryl ring was shown to be important in the modification in potency of the titled compounds in biological screening data. While the electron-withdrawing group-containing compounds 1-(4-Nitrobenzylidene)-2-(1,3-diphenylallylidene) hydrazine (ABSb) and 1-(4-chlorobenzylidene) showed potent (17 mm, 18 mm, 16 mm, 18 mm, 15 mm and 16 mm, 15 mm) antibacterial and antifungal activity, ABSc and ABSb did not. The antimicrobial activity of -2-(1,3-diphenylallylidene) hydrazine (ABSe) was less than expected. The second powerful medicine in the series (16 mm, 17 mm, 15 mm, 17 mm, 14 mm and 15 mm, 14 mm) was a furan bearing 1-(1,3-diphenylallylidene)-2-(furan-2-ylmethylene) hydrazine (ABSd). At 100 µg/mL, the unsubstituted phenyl ring compound 1-(1,3-diphenylallylidene)-2-phe nylidenehydrazine (ABSa) had considerable action against them (17 mm, 15 mm, 15 mm, 16 mm, 14 mm and 14 mm, 13 mm). All of the results pointed to compound ABSc as a potential antibacterial lead molecule, and efforts to enhance the potency of amino chalcone compounds are now planned.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

NMR: Nuclear magnetic resonance; **$CDCl_3$:** Deuterated Chloroform; **TLC:** Thin layer chromatography; **DMSO:** Dimethyl sulfoxide; **Na_2CO_3:** Sodium carbonate.

SUMMARY

The new derivatives of 1-Aryl/Alkyl amino substituted-dene-2-(-1,3-diphenylallylidene)hydrazine (ABSa-e) were synthesized, evaluated for antimicrobial and antifungal activities and compared the results with standard amoxicillin and griseofulvin drug at 100 µg/mL and also DMSO used as a solvent. Most of the compounds showed maximum activities and few of them showed least activities against specified organisms. All the synthesized compounds exhibited their activities based on their groups which was present on the parent nucleus. Among the tested compounds we proved that 1-(4-methylbenzylidene)-2-(1,3-diphenylallylidene) hydrazine (ABSc) as a potential antibacterial lead molecule in future.

REFERENCES

1. Ur Rashid HU, Xu Y, Ahmad N, Muhammad Y, Wang L. Promising anti-inflammatory effects of chalcones via inhibition of cyclooxygenase, prostaglandin E2, inducible NO synthase and nuclear factor κb activities. Bioorg Chem. 2019; 87: 335-65. doi: 10.1016/j.bioorg.2019.03.033, PMID 30921740.
2. Yang S, Shergalis A, Lu D, Kyani A, Liu Z, Ljungman M, *et al*. Design, synthesis, and biological evaluation of novel allosteric protein disulfide isomerase inhibitors. J Med Chem. 2019; 62(7): 3447-74. doi: 10.1021/acs.jmedchem.8b01951, PMID 30759340.
3. Zhuang C, Zhang W, Sheng C, Zhang W, Xing C, Miao Z. Chalcone: A Privileged Structure in Medicinal Chemistry. Chem Rev. 2017; 117(12): 7762-810. doi: 10.1021/acs.chemrev.7b00020, PMID 28488435.
4. Di Carlo G, Mascolo NDCF, Izzo AA, Capasso F. Flavonoids: old and new aspects of a class of natural therapeutic drugs. Life Sci. 1999; 65(4): 337-53. doi: 10.1016/s0024-3205(99)00120-4, PMID 10421421.
5. Wang G, Liu W, Gong Z, Huang Y, Li Y, Peng Z. Synthesis, biological evaluation, and molecular modelling of new naphthalene-chalcone derivatives as potential anticancer agents on MCF-7 breast cancer cells by targeting tubulin colchicine binding site. J Enzym Inhib Med Chem. 2020; 35(1): 139-44. doi: 10.1080/14756366.2019.1690479, PMID 31724435.
6. Zhao F, Nozawa H, Daikonnya A, Kondo K, Kitanaka S. Inhibitors of nitric oxide production from hops (*Humulus lupulus* L.). Biol Pharm Bull. 2003; 26(1): 61-5. doi: 10.1248/bpb.26.61, PMID 12520174.
7. Li R, Kenyon GL, Cohen FE, Chen X, Gong B, Dominguez JN, *et al*. *In vitro* antimalarial activity of chalcones and their derivatives. J Med Chem. 1995; 38(26): 5031-7. doi: 10.1021/jm00026a010, PMID 8544179.
8. Hamdi N, Fischmeister C, Puerta MC, Valerga P. A rapid access to new coumarinyl chalcone and substituted chromeno[4,3-c]pyrazol-4(1H)-ones and their antibacterial and DPPH radical scavenging activities. Med Chem Res. 2011; 20(4): 522-30. doi: 10.1007/s00044-010-9326-1.
9. Boeck P, Leal PC, Yunes RA, Filho VC, López S, Sortino M, *et al*. Antifungal activity and studies on mode of action of novel xanthoxyline-derived chalcones. Arch Pharm. 2005; 338(2-3): 87-95. doi: 10.1002/ardp.200400929, PMID 15799012.
10. Lahtchev KL, Batovska DI, Parushev SP, Ubiyvovk VM, Sibirny AA. Antifungal activity of chalcones: A mechanistic study using various yeast strains. Eur J Med Chem. 2008; 43(10): 2220-8. doi: 10.1016/j.ejmech.2007.12.027, PMID 18280009.
11. Liaras K, Geronikaki A; Glamo˘clija, J.; Ciri´c, A.; Sokovi´c, M. Thiazole-based chalcones as potent´ antimicrobial agents. Synthesis and biological evaluation. Bioorg. Med. Chem 2011:19(10):3135-3140; DOI: 10.1016/j.bmc.2011.04.007.
12. Nowakowska Z, K, Schroeder G ¸edzia. Synthesis, physicochemical properties and antimicrobial evaluation of new (E)-chalcones. Eur J Med Chem. 2008; 43(4): 707-13. doi: 10.1016/j.ejmech.2007.05.006, PMID 17618710.
13. Hayat F, Moseley E, Salahuddin A, Van Zyl RL, Azam A. Antiprotozoal activity of chloroquinoline based chalcones. Eur J Med Chem. 2011; 46(5): 1897-905. doi: 10.1016/j.ejmech.2011.02.004, PMID 21377771.
14. Sharma CS, Shekhawat KS, Chauhan CS, Kumar N. Synthesis and anticonvulsant activity of some chalcone derivatives. J Chem Pharm Res. 2013; 5(10): 450-4.
15. Choudhary AN, Kumar A, Juy V. Design, synthesis and evaluation of chalcone derivatives as antiinflammatory, antioxidant and antiulcer agents. Lett Drug Des Discov. 2012; 9(5): 479-88. doi: 10.2174/157018012800389368.
16. Sahu NK, Balbhadra SS, Choudhary J, Kohli DV. Exploring pharmacological significance of chalcone scaffold: a review. Curr Med Chem. 2012; 19(2): 209-25. doi: 10.2174/092986712803414132, PMID 22320299.
17. Patel NB, Patel JC, Barat GG. Synthesis and antimicrobial Activity of 2-[2-(2,6-dichlorophenyl) amino]benzyl-3-(5-substituted phenyl-4,5-dihydro-1H-pyrazol-3-ylamino)-6,8-dibromoquinazolin-4(3H)ones. J Young Pharm. 2010; 2(2): 173-82. doi: 10.4103/0975-1483.63165, PMID 21264122.
18. Shakhatreh MA K, Al-Smadi ML, Khabour OF, Shuaibu FA, Hussein EI, Alzoubi KH. Study of the antibacterial and antifungal activities of synthetic benzyl bromides, ketones, and corresponding chalcone derivatives. Drug Des Dev Ther. 2016; 10: 3653-60. doi: 10.2147/DDDT.S116312, PMID 27877017.
19. Hamada NMM, Sharshira EM. Synthesis and antimicrobial evaluation of some heterocyclic chalcone derivatives. Molecules. 2011; 16(3): 2304-12. doi: 10.3390/molecules16032304, PMID 21389908.
20. Bharat Parashar PB, Punjabi GD. Gupta and VK. Sharma; Synthesis of some novel *N*-arylhydrazone derivatives of *N*-phenyl anthranilic acid. Int J ChemTech Res. 2009; 1(4): 1022-5.
21. Gibson MZ, Nguyen MA, Zingales SK. Design, synthesis and evaluation of (2-(pyridinyl)methylene)-1-tetralone chalcones for Anticancer and antimicrobial Activity. Med Chem. 2018; 14(4): 333-43. doi: 10.2174/1573406413666171020121244, PMID 29065840.
22. Gao Z, Hurst WJ, Czechtizky W, Hall D, Moindrot N, Nagorny R, *et al*. Identification and profiling of 3,5-dimethyl-isoxazole-4-carboxylic acid [2-methyl-4-((2S,3′S)-2-methyl-[1,3′]bipyrrolidinyl-1′-yl)phenyl] amide as histamine H(3) receptor antagonist for the treatment of depression. Bioorg Med Chem Lett. 2013; 23(23): 6269-73. doi: 10.1016/j.bmcl.2013.09.081, PMID 24139584.
23. Afzal BS, Lohitha SVK, Puttagunta SB, Shaik A, Supraja K, Sai HK. Synthesis and screening of novel lipophilic diarylpropeones as prospective antitubercular, antibacterial and antifungal agents. Biointerface Res Appl Chem. 2019; 9(3): 3912-8. doi: 10.33263/BRIAC93.912918.
24. Ramírez-Prada J, Robledo SM, Vélez ID, Crespo MDP, Quiroga J, Abonia R, *et al*. Synthesis of novel quinoline-based 4,5-dihydro-1-H-pyrazoles as potential anticancer, antifungal, antibacterial, antiprotozoal agents. Eur J Med Chem. 2017; 131: 237-54. doi: 10.1016/j.ejmech.2017.03.016, PMID 28329730.
25. Sowmya DV, Lakshmi Teja G, Padmaja A, Kamala Prasad V, Padmavathi V. Green approach for the synthesis of thiophenyl pyrazoles and isoxazoles by adopting 1,3-dipolar cycloaddition methodology and their antimicrobial activity. Eur J Med Chem. 2018; 143: 891-8. doi: 10.1016/j.ejmech.2017.11.093, PMID 29227929.
26. Karthikeyan C, Moorthy NS, Ramasamy S, Vanam U, Manivannan E, Karunagaran D, *et al*. Advances in chalcones with anticancer activities. Recent Pat Anticanc Drug Discov. 2015; 10(1): 97-115. doi: 10.2174/1574892809666140819153902, PMID 25138130.

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