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Synthesis, Characterization and Pharmacological Evaluation of Some Novel 3-indole Derivatives

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ABSRACT

Various derivatives of Indole were synthesized using 3-acetylindole as a precursor. The structures of synthesized compounds were confirmed by the use of their spectral data FTIR, ^{1}H NMR and elemental analysis. The IR spectra of newly synthesized compounds showed the presence of characteristic absorption bands in the region 3100-3400, 3000-3100,1750-1800,1680-1700 and1100-1240 cm^{-1} which can be N-H stretching, Ar-H stretching, C=O stretching, C=N stretching and C-N stretching respectively. The antibacterial activity of the synthesized Indole derivatives was determined in vitro using Cup-plate method on nutrient agar medium against Gram-positive bacterial strains (B. subtilis and S. aureus) and Gram-negative bacterial strain (E. coli) and antifungal activity was carried out against diamorphic fungal strain C. albicans and another strain A. niger at 25, 50 and 100 ug/ml concentration. The zone of inhibition was measured and compared with standard drugs Roxithromycin and Fluconazole at 50 µg/ml concentration respectively. Anti-inflammatory activity was carried out using carrageenan induced rat paw edema method by Winter et al. The results revealed that newly synthesized compound was found to the most potent Anti-inflammatory compounds.

Keywords: 3-acetylindole, FTIR, ^{1}H NMR, Antibacterial, Antifungal and anti-inflammatory.

INTRODUCTION

Indole containing the pyrrole ring with benzene ring fused to α, β-position, such bicyclic heterocyclic. Indole has a benzene ring and pyrrole ring sharing one double bond. It is an important heterocyclic system with 10 electrons from four double bonds and the lone pair from the nitrogen atom. Chemical degradation of the dye gave rise to oxygenated indoles which were named indoxyl and oxoindole. Indole occurs in coal tar and in the oils of jasmine and orange blossoms.

Indole is an important heterocyclic system because it is built into proteins in the form of amino acid tryptophan, because it is the basis of drugs like indomethacin and because it provides the skeleton of indole alkaloids- biologically active compounds from plants including strychnine and LSD. Most indoles are quite stable in air, with the exception of those which carry a simple alkyl group at C-2: 2-methylindole auto oxidized easily even in a dark brown bottle. Indole may also be known as 2, 3-benzopyrrole [1-7].

Indole, Fig.1, is an important heterocyclic system because it is built into proteins in the form of amino acid tryptophan, because it is the basis of drugs like indomethacin and because it provides the skeleton of Indole alkaloids- biologically active compounds from plants including strychnine and LSD.

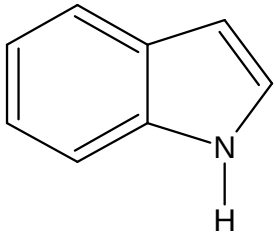


Fig. 1. General structure of Indole

It was found that there are various medicinal activities of compounds having Indol nucleus has been reported. Some of them are insecticidal, Anti-viral activities of isatin and indole oximes and anti-inflammatory activity of indole-3-acetic acids has been reported [8-10]. Fungicidal activity was exhibited by the oximes derivate of 2-substituted indoles and 3-substituted indoles, antibacterial activity of some substituted 3-(aryl) and 3-(Heteroaryl) indoles was reported. Anticancer activity of 5-Lipoxygenase inhibitor, HIV inhibitors activities of a series of new pyrimido [5, 4-b] indoles. Antioxidant activity of a series of Indole derivatives were reported [11-13]. A new series of 1H-indole-2, 3-dione derivatives were reported for in vitro antituberculosis activity against *Mycobacterium tuberculosis* H37Rv [14-18].

MATERIALS AND METHODS

Determination of melting point range

Melting points of the newly synthesized compounds Table 1, were determined by open capillary method using the melting point apparatus and were uncorrected.

Thin layer chromatography of compounds

Thin layer chromatographic analysis of synthesized compounds was performed on silica gel G coated glass plates. The mobile phases were selected according to the polarity of the compounds Benzene: Acetone (9:1) was used as mobile phase. The spots were visualized by exposure to iodine vapors.

Solubility studies

Various solvents such as water, ethanol, ethyl acetate, toluene, benzene, methanol, dimethylformamide (DMF) and diethyl ether were taken for dissolving the intermediates and final products.

Spectral analysis

UV Spectral analysis

10 mg of compounds were dissolved in DMF and were diluted to 20 ml with the same solvent. 2.0 ml of the above solution was further diluted to 50 ml. UV spectra were recorded on a UV-Visible Spectrophotometer Pharma Spec-1700 (SHIMADZU).

IR Spectral analysis:

IR spectrum of compounds was recorded on a Perkin Elmer Spectrum RXI FTIR system by using potassium bromide pellets.

^{1}H NMR Spectral analysis

^{1}H NMR Spectra of compounds was recorded on Bruker Avance II 400 NMR either in DMSO or in $CDCl_3$ using TMS as internal standard.

Synthesis of 3-(2-chlorophenyl)-1-(1H-indol-3-yl) prop-2-ene-1-one (1)

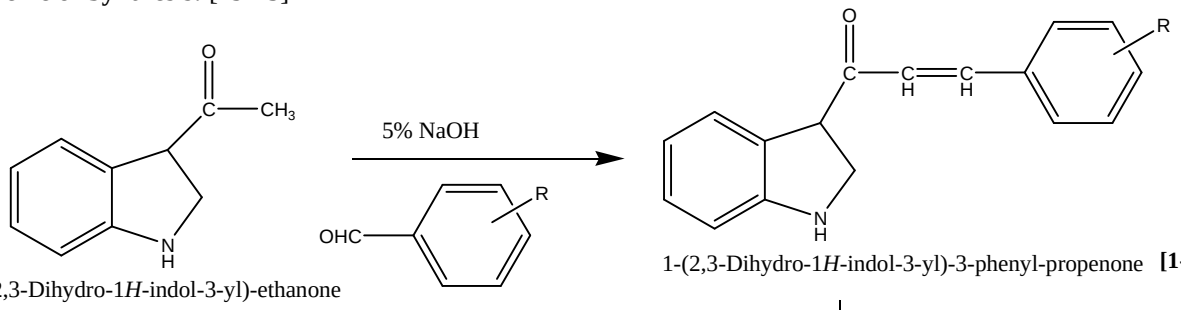
Solution of 2.0g (0.01 mol) of 3-acetylindole dissolved in 50ml of dry methanol, 1.40g (0.01 mol) of 2-chlorobenzaldehyde was dissolved in the presence of 5% NaOH solution (5ml). The reaction mixture was refluxed on water bath for 20 hrs. The solvent was distilled off and crude product was poured into ice cold water. The compound obtained was washed with water and recrystallized from ethanol to give compound **1** (1.50g, 44.6%).

3-(3-chlorophenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one (2)

To a solution of 2.0g (0.01 mol) of 3-acetylindole dissolved in 50ml of dry methanol, 1.40g (0.01 mol) of 3-chlorobenzaldehyde was added in the presence of 5% NaOH solution (5ml). The reaction mixture was refluxed on water bath for 22 hrs. The solvent was distilled off and crude product was poured into ice cold water. The compound obtained was washed with water and recrystallized from ethanol/water to give compound **2** (1.80g, 53.6%).

SYNTHETIC PROCEDURES

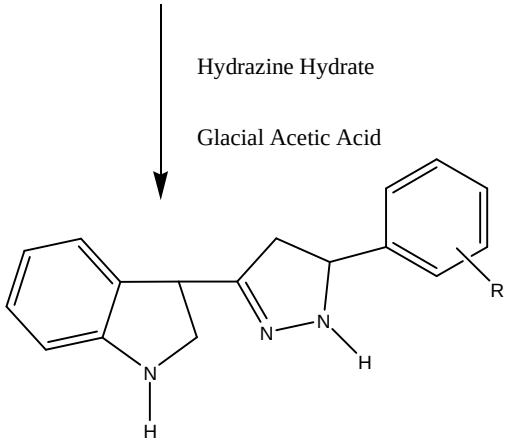
Scheme of Synthesis: [19-25]



1-(2,3-Dihydro-1*H*-indol-3-yl)-ethanone

1-(2,3-Dihydro-1*H*-indol-3-yl)-3-phenyl-propenone **[1-5]**

1 : 2-chloro
2 : 3-chloro
3 : 4-chloro
4 : 2-nitro
5 : 3-nitro
6 : 2-chloro
7 : 3-chloro
8 : 4-chloro
9 : 2-nitro
1: 3-nitro



3-(5-Phenyl-4,5-dihydro-1*H*-pyrazol-3-yl)-2,3-dihydro-1*H*-indole **[6-10]**

3-(4-chlorophenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one (3)

To a solution of 2.0g (0.01 mol) of 3-acetylindole dissolved in 50ml of dry methanol, 1.40g (0.01 mol) of 4-chlorobenzaldehyde was added in the presence of 5% NaOH solution (5ml). The reaction mixture was refluxed on water bath for 25 hrs. The solvent was distilled off and crude product was poured into ice cold water. The compound obtained was washed with water and recrystallized from ethanol to give compound **3** (2.10 g, 62.5%).

Synthesis of 3-(2-nitrophenyl)-1-(1H-indol-3-yl)prop-2-ene-1-one (4)

To a solution of 2.0g (0.01 mol) of 3-acetylindole dissolved in 50ml of dry methanol, 1.51g (0.01 mol) of 2-nitrobenzaldehyde was added in the presence of 5% NaOH solution (5ml). The reaction mixture was refluxed on water bath for 21 hrs. The solvent was distilled off and crude product was poured into ice cold water. The compound obtained was washed with water and recrystallized from water/acetone to give compound **4** (1.72g, 46.9%).

Synthesis of 3-(3-nitrophenyl)-1-(1H-indol-3-yl) prop-2-ene-1-one (5)

To a solution of 2.0g (0.01 mol) of 3-acetylindole dissolved in 50ml of dry methanol, 1.51g (0.01 mol) of 3-nitrobenzaldehyde was added in the presence of 5% NaOH solution (5ml). The reaction mixture was refluxed on water bath for 22 hrs. The solvent was distilled off and crude product was poured into ice cold water. The compound obtained was washed with water and recrystallized from ethanol/water to give compound **5** (1.64g, 44.7%).

Synthesis of 3-[5-(2-chlorophenyl)-2′-pyrazolin-3′-yl]-indole (6)

To a solution of 0.5g (0.002 mol) of compound **1** dissolved in 20ml ethanol, 0.2g (0.2ml, 0.004 mol) of 99% hydrazine hydrate and few drops of glacial acetic acid were added. The reaction mixture was refluxed for 12 hrs. The excess solvent was distilled off and crude product obtained was poured into ice cold water. The separated solid was filtered and recrystallized from ethanol to give compound **6** (0.250g, 45.5%).

Synthesis of 3-[5-(3-chlorophenyl)-2′-pyrazolin-3′-yl]-indole (7)

To a solution of 0.5g (0.002 mole) of compound **2** dissolved in 20ml ethanol, 0.2g (0.2ml, 0.004 mol) of 99% hydrazine hydrate and few drops of glacial acetic acid were added. The reaction mixture was refluxed for 15 hrs. The excess solvent was distilled off and crude product obtained was poured into ice cold water. The separated solid was filtered and recrystallized from benzene to give compound **7** (0.200g, 36.7%).

Synthesis of 3-[5-(4-chlorophenyl)-2′-pyrazolin-3′-yl]-indole (8)
To a solution of 0.5g (0.002 mol) of compound **3** dissolved in 20ml ethanol, 0.2g (0.2ml, 0.004 mol) of 99% hydrazine hydrate and few drops of glacial acetic acid were added. The reaction mixture was refluxed for 15 hrs. The excess solvent was distilled off and crude product obtained was poured into ice cold water. The separated solid was filtered and recrystallized from acetone/water to give compound **8** (0.310g, 56.4%).

Synthesis of 3-[5-(2-nitrophenyl)-2′-pyrazolin-3′-yl]-indole (9)
To a solution of 0.5g (0.002 mol) of compound **4** dissolved in 20ml ethanol, 0.2g (0.2ml, 0.004 mol) of 99% hydrazine hydrate and few drops of glacial acetic acid were added. The reaction mixture was refluxed for 10 hrs. The excess solvent was distilled off and crude product obtained was poured into ice cold water. The separated solid was filtered and recrystallized from acetone to give compound **9** (0.200g, 38.5%).

Synthesis of 3-[5-(3-nitrophenyl)-2′-pyrazolin-3′-yl] Indole (10)
To a solution of 0.5g (0.002 mol) of compound **5** dissolved in 20ml ethanol, 0.2g (0.2ml, 0.004 mol) of 99% hydrazine hydrate and few drops of glacial acetic acid were added. The reaction mixture was refluxed for 12 hrs. The excess solvent was distilled off and crude product obtained was poured into ice cold water. The separated solid was filtered and recrystallized from acetone to give compound **10** (0.110g, 21.2%).

BIOLOGICAL EVALUATION

Antibacterial activity
Serial plate dilution method was used in the present study for the evaluation of antibacterial activity against antibacterial strains of *B. subtilis*, *E. coli* and *S. aureus*. Test samples were tested at 25, 50 and 100 mg mL^{-1} concentration in DMF. Roxithromycin (ROX) in concentration of 100 □g ml^{-1} was used as a standard drug for antibacterial activity and activity was determined by measuring the diameter of the inhibition zone for triplicate sets. The diameters obtained for the test sample were compared with that produced by the standard drug ROX. The antibacterial results of studies are reported in Table 2 and Fig. 2.

Antifungal Activity
Antifungal activity was carried out against diamorphic fungal strain *C. albicans* and another strain *A. niger* at 25, 50 and 100 µg/ml concentration. The zone of inhibition was measured and compared with standard drugs Fluconazole at 100 µg/ml concentration respectively. The Antifungal results of studies are reported in Table 3 and Fig. 3.

RESULTS AND DISCUSSION

Characteristic data of synthesized compounds
Synthesis of 3-(2-chlorophenyl)-1-(1H-indol-3-yl) prop-2-ene-1-one (1): TLC (Benzene: Acetone, 9:1, v/v): R_f: 0.60, UV λ_{max} (DMF): 283.0, 341.5 nm. IR (KBr) υ: 3172.7(N-H stretching), 3054.7(aromatic C-H stretching), 1744.3(C=O stretching), 1640.1(CH=CH- stretching), 1573.7(-C=C- of aromatic ring), 1236.8(C-N stretching), 1097.2 cm^{-1}(C-Cl). ^{1}H NMR (DMSO): δ 7.26-7.29(m, 2H, -CH=CH-), 7.3-8.46(m, 9H, Ar-H), 11.49(s, 1H, N-H) Calculated for $C_{17}H_{12}Cl$ NO: C, 72.47; H, 4.29; N, 4.97. Found: C, 72.45; H, 4.28; N, 4.95.

3-(3-chlorophenyl)-1-(1H-indol-3-yl)prop-2-ene-1-one (2): TLC (Benzene: Acetone, 9:1, v/v): R_f : 0.55 UV λ_{max} (DMF): 282.0, 340.5 nm IR (KBr) υ: 3180.2 (N-H stretching), 3097.4 (aromatic C-H stretching), 1742.0 (C=O stretching), 1640.7 (-C=C- of aromatic ring), 1564.0 (-CH=CH-), 1235.4 (C-N stretching), 1094.2 cm^{-1} (C-Cl). ^{1}H NMR (DMSO): δ 7.26-8.44 (m, 9H, Ar-H), 7.34-7.36 (m, 2H, -CH=CH-), 11.60 (s, 1H, N-H) Calculated. For $C_{17}H_{12}Cl$ NO: C,72.47; H, 4.29; N, 4.97. Found: C, 72.46; H, 4.26; N, 4.96.

3-(4-chlorophenyl)-1-(1H-indol-3-yl)prop-2-ene-1-one (3): TLC (Benzene: Acetone, 9:1, v/v): R_f : 0.48, UV λ_{max} (DMF): 284.5, 341.0 nm, IR (KBr) υ: 3101.7(N-H stretching), 3042.7(aromatic C-H stretching), 1792.6(C=O stretching), 1638.9(-CH=CH- stretching), 1561.3(-C=C- of aromatic ring), 1154.6(C-N stretching), 1097.2 cm^{-1} (C-Cl). ^{1}H NMR (DMSO): δ 7.24-7.27 (m, 2H, -CH=CH-), 7.38-8.19 (m, 9H, Ar-H), 11.58 (s, 1H, N-H) Calculated for $C_{17}H_{12}Cl$ NO: C,72.47; H, 4.29; N, 4.97, Found: C, 72.43; H, 4.27; N, 4.94.

Synthesis of 3-(2-nitrophenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one (4): TLC (Benzene: Acetone, 9:1, v/v): R_f: 0.25 UV λ_{max} (DMF): 291.0 nm, IR (KBr) υ: 3151.9 (N-H stretching), 3076.9 (aromatic C-H), 1684.8 (C=O stretching), 1651.1 (-CH=CH- stretching), 1559.9 (-C=C- of aromatic ring), 1239.7 (C-N stretching), 1094.9 cm^{-1} (C-Cl). ^{1}H NMR ($CDCl_3$): δ 7.23 (m, 2H, -CH=CH-), 7.28-8.54 (m, 9H, Ar-H), 11.28 (s, 1H, N-H), Calculated for $C_{17}H_{12}N_2O_3$: C, 69.86; H, 4.14; N, 9.58. Found: C, 69.84; H, 4.12; N, 9.55.

Synthesis of 3-(3-nitrophenyl)-1-(1H-indol-3-yl) prop-2-ene-1-one (5): TLC (Benzene: Acetone, 9:1, v/v): R_f: 0.28 UV λ_{max} (DMF): 282.0, 342.0 nm, IR (KBr) υ: 3172.0 (N-H stretching), 3076.9 (aromatic C-H), 1642.1 (-CH=CH-), 1558.9 (-C=C- of aromatic ring), 1520.7 (symmetrical N-O stretching), 1235.7 cm^{-1} (C-N stretching).^{1}H NMR (DMSO): δ 7.23 (m, 2H, -CH=CH-), 7.44-8.54 (m, 9H, Ar-H), 11.45 (s, 1H, N-H) Calculated for $C_{17}H_{12}N_2O_3$: C, 69.86; H, 4.14; N, 9.58. Found: C, 69.85; H, 4.11; N, 9.54.

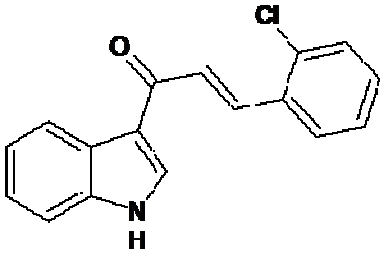
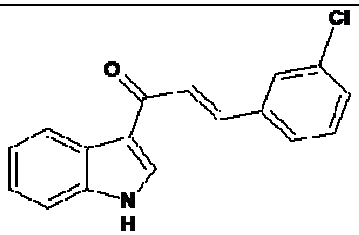
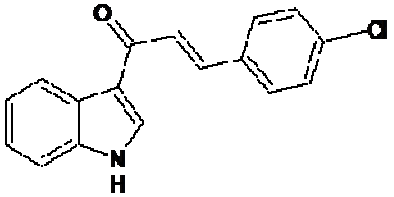
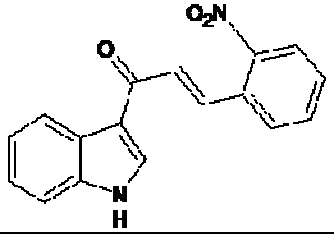
Synthesis of 3-[5-(2-chlorophenyl)-2′-pyrazolin-3′-yl]-indole (6): TLC (Benzene: Acetone, 9:1, v/v): R_f: 0.45**,** UV λ_{max} (DMF): 343.0 nm**,** IR (KBr) υ: 3173.0 (N-H stretching), 3060.0 (aromatic C-H), 1685.4 (C=N stretching), 1568.9 (-C=C- of aromatic ring), 1525.5 (N-N stretching), 1211.4 (C-N stretching), 1090.3 cm^{-1} (C-Cl). ^{1}H NMR ($CDCl_3$): δ 7.05 (m, 2H, -CH_2 of pyrazoline ring), 7.17-7.78 (m, 10H, Ar-H), 8.30 (m, 1H, N-H of pyrazoline ring), 8.64 (s, 1H, N-H of indole).

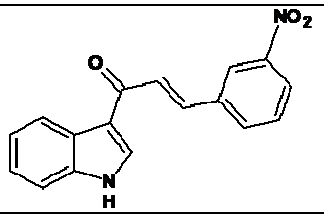
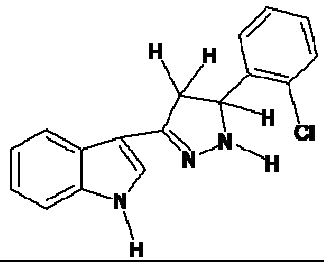
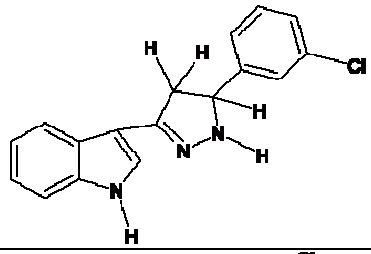
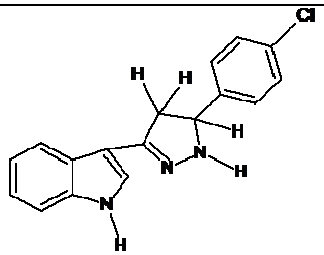
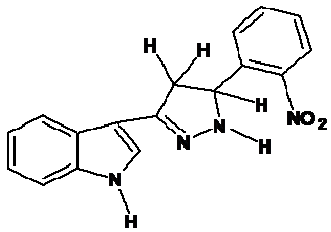
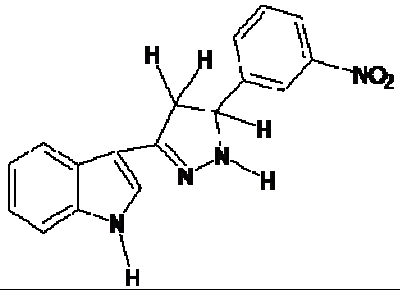
Calculated for $C_{17}H_{14}Cl\ N_3$: C, 69.03; H, 4.77; N, 14.21. Found: C, 69.01; H, 4.73; N, 14.19.

Synthesis of 3-[5-(3-chlorophenyl)-2′-pyrazolin-3′-yl]-indole (7): TLC (Benzene: Acetone, 9:1, v/v): R_f: 0.63, UV λ_{max} (DMF): 276.0, 342.0 nm. IR (KBr) υ: 3131.4 (N-H stretching), 2919.5 (aromatic C-H), 1570.5 (-C=C- of aromatic ring), 1523.5 (N-N stretching), 1170.2 (C-N stretching), 1104.3 cm^{-1} (C-Cl). ^{1}H NMR (DMSO): δ 6.27 (d, 2H, -CH_2 of pyrazoline ring), 7.06-7.74 (m, 10H, Ar-H), 8.47 (m, 1H, N-H of pyrazoline ring), 11.00 (s, 1H, N-H of indole). Calculated For $C_{17}H_{14}Cl\ N_3$: C, 69.03; H, 4.77; N, 14.21. Found: C, 69.02; H, 4.75; N, 14.18.

Synthesis of 3-[5-(4-chlorophenyl)-2′-pyrazolin-3′-yl]-indole (8): TLC (Benzene: Acetone, 9:1, v/v): R_f: 0.66, UV λ_{max} (DMF): 342.0 nm, IR (KBr) υ: 3191.4 (N-H stretching), 2919.4 (aromatic C-H), 1688.3 (C=N stretching), 1585.0 (-C=C- of aromatic ring), 1521.3 (N-N stretching), 1170.9 (C-N stretching), 1105.3 cm^{-1} (C-Cl). ^{1}H NMR ($CDCl_3$): δ 5.31 (d, 2H, -CH_2 of pyrazoline ring), 7.14-7.53 (m, 10H, Ar-H), 8.35 (m, 1H, N-H of pyrazoline ring), 9.40 (s, 1H, N-H of indole). Calculated for $C_{17}H_{14}Cl\ N_3$: C, 69.03; H, 4.77; N, 14.21. Found: C, 69.05; H, 4.79; N, 14.23.

Table 1: IUPAC name and structure of synthesized compounds

S. No.	Name of compound	Structure	M. P.
1.	3-(2-chlorophenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one		240-242 ºC.
2.	3-(3-chlorophenyl)-1-(1H-indol-3-yl)prop-2-ene-1-one		228-232 ºC
3.	3-(4-chlorophenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one		260-262ºC
4.	3-(2-nitrophenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one		178-180 ºC

5.	3-(3-nitrophenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one		152-158 ºC
6.	3-[5-(2-chlorophenyl)-2´-pyrazolin-3´-yl]-1H-indole		160-162 ºC
7.	3-[5-(3-chlorophenyl)-2´-pyrazolin-3´-yl]-1H-indole		282-284 ºC
8.	3-[5-(4-chlorophenyl)-2´-pyrazolin-3´-yl]-1H-indole		88-90ºC
9.	3-[5-(2-nitrophenyl)-2´-pyrazolin-3´-yl]-1H-indole		230-235ºC
10.	3-[5-(3-nitrophenyl)-2´-pyrazolin-3´-yl]-1H-indole		270-272ºC

Synthesis of 3-[5-(2-nitrophenyl)-2′-pyrazolin-3′-yl]-indole (9): TLC (Benzene: Acetone, 9:1, v/v): R_f : 0.40, UV λ_{max} (DMF): 275.5, 342.5 nm, IR (KBr) υ: 3130.9 (N-H stretching), 2920.7 (aromatic C-H), 1682.7 (C=N stretching), 1584.5 (-C=C- of aromatic ring), 1523.7 (symmetrical N-O stretching), 1488.3 (N-N stretching), 1141.4 cm^{-1} (C-N stretch).^{1}H NMR (DMSO): δ 6.18 (d, 2H, -CH_2 of pyrazoline ring), 7.11-8.56 (m, 10H, Ar-H), 9.32 (m, 1H, N-H of pyrazoline ring), 11.03 (s, 1H, N-H of indole).Calculated. For $C_{17}H_{14}N_4O_2$: C, 66.66; H, 4.61; N, 18.29.Found: C, 66.68; H, 4.63; N, 18.30.

Synthesis of 3-[5-(3-nitrophenyl)-2′-pyrazolin-3′-yl] Indole (10): TLC (Benzene: Acetone, 9:1, v/v): R_f : 0.22, UV λ_{max} (DMF): 278.0, 340.5 nm, IR (KBr) υ: 3181.4 (N-H stretching), 2925.6 (aromatic C-H), 1642.9 (C=N stretching), 1562.9 (-C=C- of aromatic ring), 1522.1 (symmetrical N-O), 1151.5 (C-N stretching), 1096.9 cm^{-1} (N-N stretching).

^{1}H NMR (DMSO): δ 7.24-8.47 (m, 10H, Ar-H), 8.53-8.54 (d, 2H, N-H of pyrazoline ring), 11.49 (s, 1H, N-H). Calculated for $C_{17}H_{14}N_4O_2$: C, 66.66; H, 4.61; N, 18.29. Found: C, 66.65; H, 4.60; N, 18.26.

Screening of antibacterial and antifungal activity

The compounds synthesized were evaluated for their *in vitro* growth inhibitory activity against a variety of strains of bacteria and fungi. The Gram-positive strains used were *B. subtilis*, *S. aureus*, and Gram-negative strain *E. coli* while fungi tested were diamorphic fungal strains *A. niger* and *C. albicans.* Cup-plate method was used for both the strains. Roxithromycin and Fluconazole were used as standard drugs against bacterial and fungal strains respectively, at concentration of 100 mg/ml along with DMF as solvent. The results of antimicrobial activity are summarized in tables 2 and 3 respectively.

The results revealed that novel synthesized compounds 3, 8 and 9 were found to be potent against *B. subtilis*, compounds 1, 9 against *S. aureus*, and 8 against *E. coli* showed good zone of inhibition at concentration of 100 mg/ml. Similarly, compounds 4 and 9 were found to be potent against *A. niger* and 1, 4 and 5 against *C. albicans* at concentration of 50 mg/ml.

Results further revealed that compound 5 possessed comparable antibacterial activity with that of standard drug roxithromycin against *E.coli*. Similarly, compounds 6 possessed comparable antifungal activity with that of standard drug fluconazole.

The results further revealed that novel synthesized compounds possessed good antibacterial activity as well as antifungal activity.

Table 2: Antibacterial activity of compounds

Code of compounds	Diameter of zone of inhibition (mm) [mean ± S.D. (n=3)]								
	B. subtilis			*E. coli*			*S. aureus*		
	25 µg ml^{-1}	50 µg ml^{-1}	100 µg ml^{-1}	25µg ml^{-1}	50 µg ml^{-1}	100 µg ml^{-1}	25 µg ml^{-1}	50 µg ml^{-1}	100 µg ml^{-1}
1	3.26± 0.40	5.06± 0.31	10.20± 0.42	4.53± 0.83	6.60 ± 0.83	11.26 ± 0.57	6.40 ± 0.40	11.06 ± 0.61	18.66 ± 0.61
2	4.53± 0.53	6.66± 0.42	11.60± 0.50	3.2 ± 0.40	5.73 ± 0.61	11.06 ± 0.46	4.66 ± 0.69	7.33 ± 0.23	10.66 ± 0.83
3	6.33± 0.40	10.4± 0.53	16.4± 0.42	4.66± 0.83	8.86± 0.80	14.26± 0.46	4.53± 0.23	10.66±0.83	16.80 ± 0.80
4	4.20± 0.50	6.26± 0.31	11.26± 0.50	6.40± 0.40	10.53± 1.00	16.0± 0.40	0.00 ± 0.00	5.2± 0.40	10.66 ± 0.83
5	4.73± 0.42	8.60± 0.40	14.46± 0.50	7.46± 0.61	13.73± 1.00	21.6± 0.40	5.2± 0.40	7.56± 0.40	12.66 ± 0.83
6	4.33± 0.41	6.53± 0.61	12.66± 0.42	4.40± 0.40	6.53± 0.46	12.26 ± 0.61	4.80± 0.69	6.73± 0.75	12.13 ± 1.00
7	4.86± 0.42	8.46± 0.31	14.33± 0.50	3.33± 0.83	4.66± 0.83	10.66± 0.61	4.00± 0.40	6.93± 0.61	11.46 ± 1.00
8	6.60± 0.31	11.60±0.40	17.93± 0.40	4.66± 0.40	12.93± 0.46	18.0± 0.40	4.53± 0.61	6.93± 1.01	13.46± 0.61
9	6.80± 0.31	12.06±0.30	19.33± 0.40	6.13± 0.61	8.93± 0.83	13.6± 0.80	6.40± 1.05	8.53± 0.61	19.06± 0.61
10	4.60± 0.20	6.33± 0.42	12.40± 0.40	4.80 ± 0.20	11.4 ± 0.20	15.73 ± 0.31	3.73 ± 0.31	5.60 ± 0.40	10.93 ± 0.31
ROX	-	-	19.53± 0.30	-	-	20.8 ± 0.40	-	-	19.73± 0.92

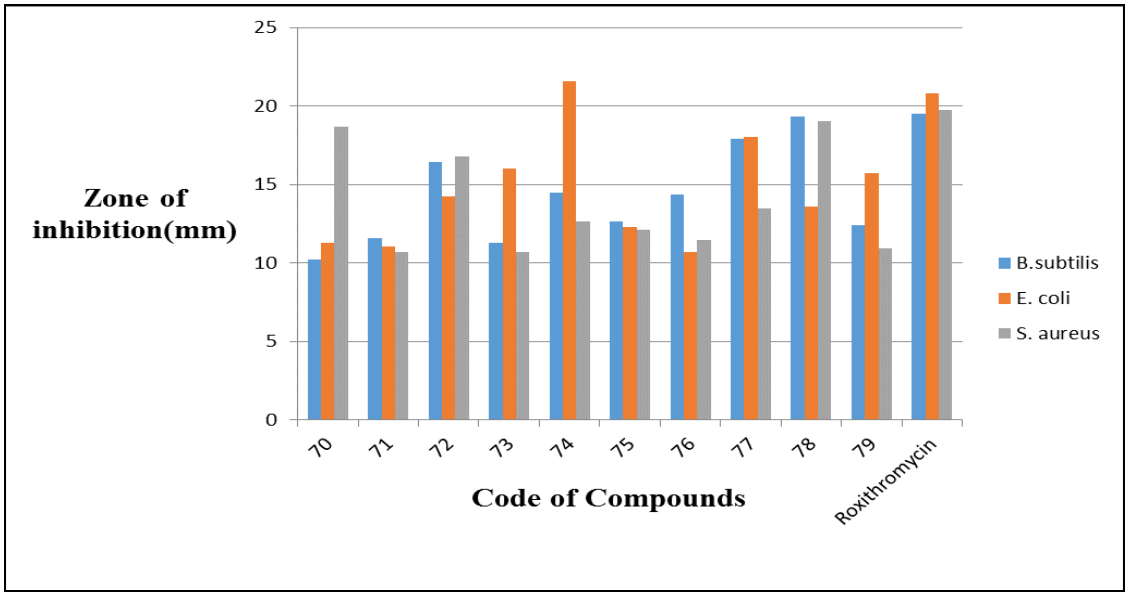


Fig 2: Graphical representation for antibacterial activity.

Table 3: Antifungal activity of compounds

Code of compounds	Diameter of zone of inhibition in mm [mean ± S.D. (n=3)]					
	C. albicans			*A. niger*		
	25 µg ml^{-1}	50 µg ml^{-1}	100 µg ml^{-1}	25 µg ml^{-1}	50 µg ml^{-1}	100 µg ml^{-1}
1(2-chloro 1st step)	6.26± 0.21	8.00± 0.40	12.26 ± 0.23	4.53± 0.23	6.80± 0.80	11.86± 0.61
2(2-chloro 2nd step)	5.60± 0.80	8.00± 0.40	12.40 ± 0.40	6.53± 0.61	10.0± 0.40	15.33± 0.83
3(3-chloro 1st step)	6.53± 0.46	11.46± 0.61	16.40 ± 0.40	4.66± 0.61	6.66± 0.46	11.86± 1.22
4(3-chloro 2nd step)	5.06± 0.23	6.66± 0.61	11.2 ± 0.34	4.0± 0.40	5.73± 0.61	10.0± 0.40
5(4-chloro 1st step)	5.60± 0.80	6.40± 040	12.0 ± 0.80	4.0± 0.80	6.53± 0.46	10.40 ± 0.80
6(4-chloro 2nd step)	6.20± 0.91	11.20± 1.05	13.46 ± 1.00	5.73± 0.83	7.60± 1.20	11.86± 061
7(2-nitro 1st step)	6.13± 1.00	11.46± 0.46	15.86± 0.46	6.13± 0.61	9.60± 0.69	14.8± 1.20
8(2-nitro 2nd step)	4.93± 0.61	7.06± 1.22	10.66 ± 0.61	6.26± 0.23	9.60± 0.40	14.53± 0.23
9(3-nitro 1st step)	6.93± 1.01	10.8± 0.40	15.46 ± 0.46	4.66± 0.46	5.73± 0.61	11.06± 0.83
Fluconazole			16.93 ± 0.83	-	-	15.86± 0.46

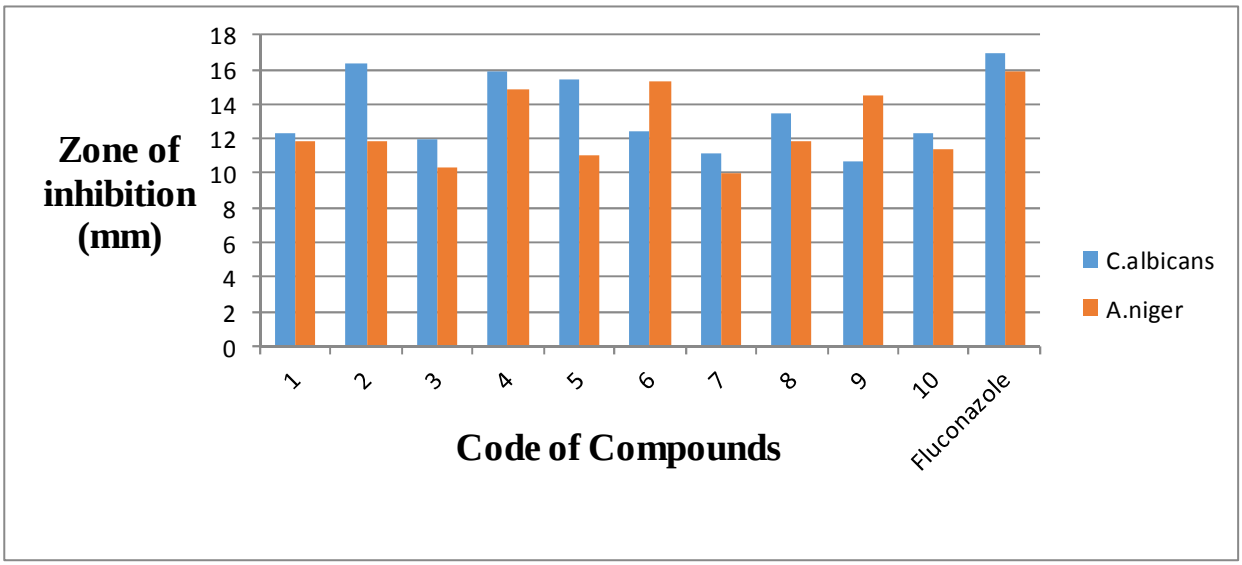


Fig 3: Graphical representation for antifungal activity.

CONCLUSION

The novel indole derivatives 3-(substituted phenyl)-1-(1H-indol-3-yl)-prop-2-ene-1-one were synthesized by condensation of 3-acetylindole with different Benz aldehydes. These derivatives were then reacted with hydrazine hydrate in presence of glacial acetic acid. Synthesized compounds were identified on the basis of melting point range, Rf values, solubility in different solvents, elemental analysis, UV absorbance, IR and ^{1}H NMR spectral analysis. IR and ^{1}H NMR spectral data confirmed the identity of the synthesized compounds.

The synthesis work is fruitless without performing biological activities, so the newly synthesized compounds were screened for antibacterial. The synthesized compounds were screened for their antibacterial and antifungal, antifungal and anti-inflammatory activities. Antimicrobial activity was screened against Gram positive and Gram negative bacteria and against diamorphic species of fungi by cup-plate method, using nutrient agar medium. The results revealed that newly synthesized compounds 3, 8 and 10 were found to be potent against *B. subtilis;* 1, 9 against *S. aureus* and 8 against *E. coli* while 4, 9 were found to be potent against *A. niger* and 2, 4, 5 against *C. albicans*.
In the present study all the synthesized compounds showed activity against Gram positive bacteria like *B. subtilis; S. aureus* and Gram negative bacteria *E. coli.* Thus the compounds synthesized could be used as broad spectrum antibacterial agents. Another important feature of synthesized compounds was their activity against fungi.

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