Spectral studies and Antimicrobial activities of newly synthesized 2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]-*N*-phenylacetamide derivatives containing a triazole nucleus

Dilip Ghule[1*], Pradnya Prabhu[1], Bharati Choudhari[2], Jaidip Wable[1], Jitendra Suryavanshi[3] and Shrikrishna Vengurlekar[3]

[1]Chemistry Department, K. J. Somaiya College of Science and Commerce, Vidyavihar, Mumbai, India- 400077.

[2]SAH Dept, K. J. Somaiya College of Engineering, SVU, Vidyavihar, Mumbai, India- 400077.

[3]Lysca Pharmaceuticals Pvt Ltd (R-890), TTC Industrial area, Rabale MIDC, Rabale, Navi Mumbai, India- 400708.

[*]Corresponding Author: dilip.ghule0@gmail.com

Abstract

A number of 2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]-*N*-phenylacetamide derivatives **KJSSCDG01-10** were produced through the reaction of [3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1H-1,2,4-triazol-1-yl] acetic acid **2** with substituted aniline **1a-1j**. Their structures were determined to be correct using techniques such as ^{1}H NMR, ^{13}C NMR, MS, IR, and elemental studies. The antibacterial and antifungal properties of all the components have been investigated. Using the cup plate method, the compounds were found to be highly effective against gram-positive (*S. aureus*) and gram-negative (*E. coli*) bacteria, as well as the fungus *A. niger*.

Keywords: 1,2,4-triazole, substituted benzaldehyde, antibacterial and antifungal properties

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1. Introduction:

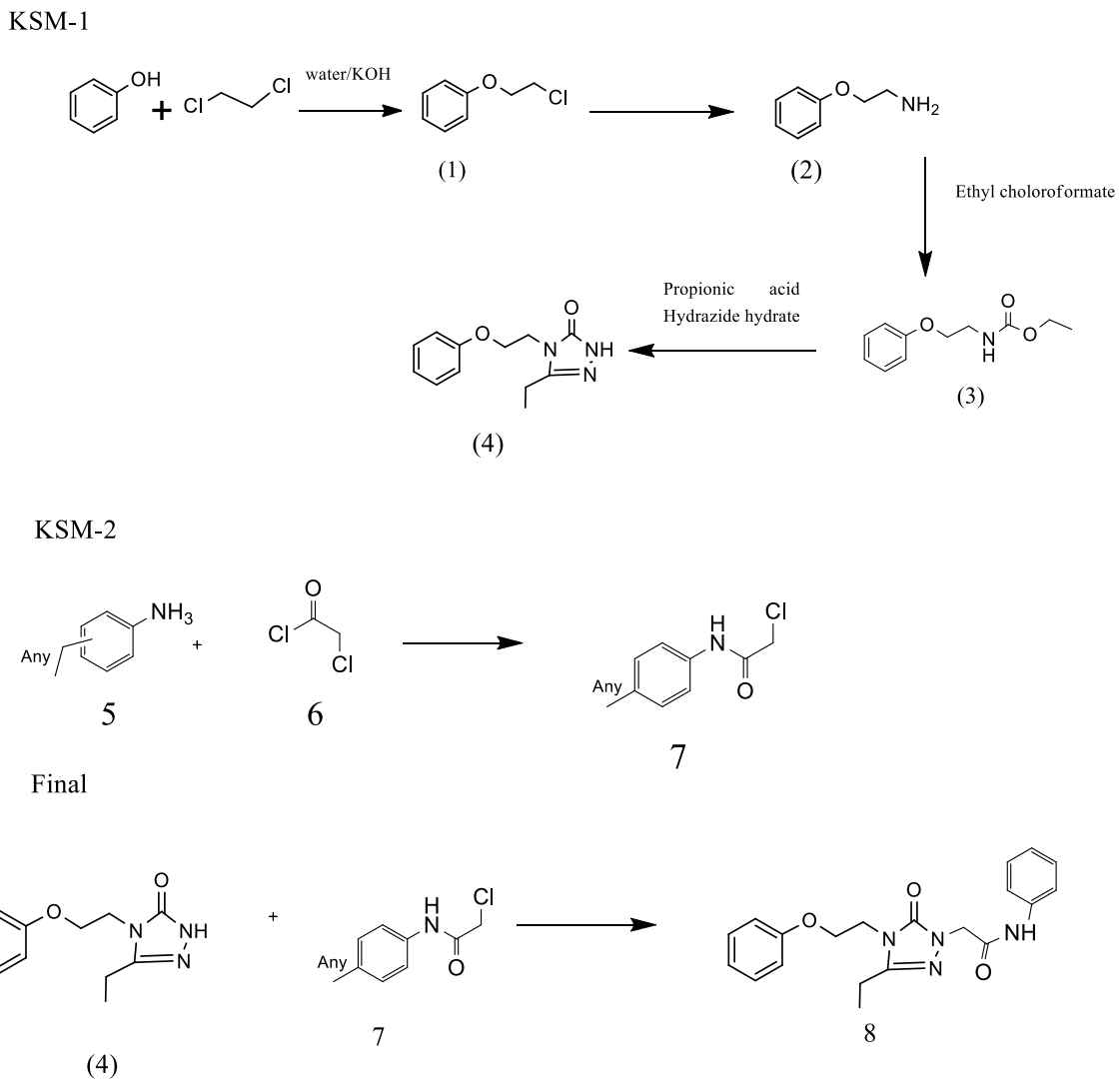
The sub-discipline of organic chemistry, known as heterocyclic chemistry, has been around for quite some time and has a bright future. Purine and pyrimidine bases (the structural components of DNA and RNA) are examples of heterocyclic chemicals essential to life. Heterocyclic chemistry now contributes reagents and synthetic procedures to the associated domains of biochemistry[1, 2], polymers[2, 3], Dyes[4, 5], and material sciences[6], in addition to its traditional applications in the production of medicines[7], insecticides[8], and detergents[9].

Because of their fascinating physiological features, several five-membered aromatic complexes containing three hetero atoms in symmetrical positions have been the subject of research[10-11]. It is also well recognised that numerous derivatives of 1, 2, 4-triazole and 1, 3, 4-thiadiazole exhibit a broad spectrum of pharmacological properties such as antibacterial and

antifungal activity. These derivatives can be found in many pharmaceutical products[12-13]. Terconazole, itraconazole, fluconazole, cefazoline, and ribavirin are some examples of drugs that are now accessible that include one of these heterocyclic nuclei. Other examples include *fluconazole*. In light of the information presented above, and as a continuation of our research into the synthesis of biologically relevant heterocyclic compounds[14-16], the purpose of this article is to discuss the synthesis of certain 2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]-*N*-phenylacetamide derivatives, as well as an analysis of the antibacterial properties of these compounds. In **Scheme 1**, the series of reactions that lead to the preparation of the desired heterocyclic compounds is described in detail. ^{1}H NMR, ^{13}C NMR, MS, IR, and spectral data were used to determine the structures of the compounds.

2. Experimental:

S. d. fine chem. supplied all of the chemicals. Uncorrected melting points were measured in open capillaries for all synthesised compounds. Thin-layer chromatography (TLC) on silica gel 60 F254 aluminium sheets was used to observe the progress of the reactions. Ethyl acetate was used as the mobile phase, while UV light was used for detection. IR spectra were captured as potassium bromide pellets using a Brucker FTIR spectrometer. A Bruker Advance II 400 MHz NMR Spectrometer (chemical shift in ppm downfield from TMS as an internal reference), ^{1}H-NMR and ^{13}C-NMR spectra were acquired. The Bruker IMPACT HD was used to acquire the mass spectra.



Scheme 1: Process for the synthesis of compound **KJSSCDG01-10**

Preparation of compound-1

A stirred solution of phenol 25 g in water, 150 mL sodium hydroxide 32 g and dichloroethane 100 mL at 90-95 °C temperature for 12 hr, cool reaction mass and separated the organic layer was washed by 10 % sodium hydroxide solution and then washed with water, removed out solvent under pressure at 60-65 ° C. 25 g oil product (**1**) obtained.

Preparation of compound-2

Take compound (**1**) in 150 mL dichloromethane and cool the reaction mass at 0-5°C, add methanolic ammonia and heat the reaction mass at 80-85 °C under pressure reactor for 5 h, reaction completed, distilled out reaction mass and water in reaction mass, extracted by Dichloromethane and distilled out solvent under vacuum we get oily compound (**2**).

Preparation of compound-3

Take compound (**2**) (1.0-mol) in dichloromethane and cool reaction mass at 0-5°C, add in it(1.25-mol) triethyl amine, stir well, and slowly add in it ethyl chloroformate (1.25-mol) after complete addition stir for 1.0 h. checked TLC reaction complies, charged ice water and a separate organic layer, the aqueous layer extracted by dichloromethane, all organic layer combined and washed with water and brine solution, the organic layer dried over sodium sulphate, organic layer distilled out under vacuum. low melting solid product (**3**) obtained.

Preparation of compound-4

Take above compound (**3**) in RBF charged 10 volume xylene and (1.5-mol) propanoic acid hydrazide) the heated reaction mass was up to 115° to 120°C and added slowly sodium ethoxide solution (1.5-mol) was after complete addition, stirred reaction mass 5 h at 115-120 °C, checked TLC and the reaction was completed, the cool reaction mass up to 25-30°C and add in it, water, acidify the reaction mass using conc. HCl, solid fall out, filter the solid and purified using crystallisation using Isopropyl alcohol. To get (4) as a white solid compound (**4**)

Preparation of compound-7a-j

The stirred solution of appropriate aniline **5a-j** (20 mmol) in 20 mL dichloromethane (DCM) and triethyl amine (20 mmol) was added, the reaction mixture was stirred at 0°C and added chloroacetyl chloride (20 mmol), and then stirred at room temperature for 3-5 h, checked TLC in MDC: Methanol as a solvent, the reaction mixture is quenched by crushed ice. The product was extracted by dichloromethane as a solvent. The solvent was removed under reduced pressure, and the solid product was obtained (**7**) (85-95 % yield).

Preparation of compound- KJSSCDG01-10

Stirred compound (**4**) (1.0 mol) and compound (**7**a-j) (1.0 mol) in Ethyl alcohol 10 times, and add sodium hydroxide (2.0-mol) as a base, heated reaction mass up to 75-80 °C for 12 h, Checked TLC reaction completed, cool RM and filter it and washed with ethyl alcohol, Organic solvent distilled out under vacuum, solid material obtained, Purification solid by crystallisation in Ethyl alcohol. We get the final compounds (**KJSSCDG01-10**)

***N*-(2-chlorophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG01)**. (Yield: 81%); mp 158-159 ˚C; IR (KBr, ν, cm^{-1}): 3249 (N-H), 2985 (-CH_3), 1721/1672 (C=O), 1585 (ArC=N), 1536 (NH), 752 (C-Cl); ^{1}H-NMR (DMSO-d_6)

δ (ppm): 1.4 (t, 3H, CH_3), 2.78 (q, 2H, -CH_2-), 2.81 (1H, NH), 4.17 (t, 2H, CH_2N), 4.23 (t, 2H, -CH_2-O), 4.61 (s, 2H, N-CH_2-CO), 6.82-8.55 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 9.73 (-CH_3), 19.31 (-CH_2-), 41.57 (-CH_2-N), 48.92 (N-C-CO), 65.09 (-CH_2-O), 114.21 (Ar C2/C6), 122.83 (Ar C4), 129.62 (Ar C3/C5), 134.79 (Ar C1), 121.59 (Ar C2), 128.99 (Ar C3), 127.69 (Ar C4), 124.915 (Ar C5), 121.59 (Ar C6), 150.13 (C=N), 157.86 (CON), 165.33 (CO); MS (ESI): m/z (%) 401.14 ([M+1]. Anal. Calcd. (%) for $C_{20}H_{21}ClN_4O_3$: C, 59.92; H, 5.28; Cl, 8.84; N, 13.98; O, 11.37.

***N*-(3-chlorophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG02)**. (Yield: 78%); mp 177-178 ˚C; IR (KBr, ν, cm^{-1}): 3387 (N-H), 3072 (-CH_3), 1691 (C=O), 1549 (ArC=N), 1564 (NH), 746 (C-Cl); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.35 (t, 3H, CH_3), 1.68 (q, 2H, -CH_2-), 2.76 (1H, NH), 4.05 (t, 2H, CH_2N), 4.29 (t, 2H, -CH_2-O), 4.58 (s, 2H, N-CH_2-CO), 6.83-8.60 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 9.76 (-CH_3), 19.28 (-CH_2-), 41.63 (-CH_2-N), 49.76 (N-C-CO), 65.08 (-CH_2-O), 114.22 (Ar C2/C6), 120.07 (Ar C4), 129.66 (Ar C3/C5), 134.58 (Ar C1), 121.59 (Ar C2), 129.91 (Ar C3), 124.58 (Ar C4), 117.97 (Ar C5), 121.58 (Ar C6), 149.84 (C=N), 157.83 (CON), 165.24 (CO); MS (ESI): m/z (%) 400.93 ([M+1]. Anal. Calcd. (%) for $C_{20}H_{21}ClN_4O_3$: C, 59.92; H, 5.28; Cl, 8.84; N, 13.98; O, 11.37.

***N*-(4-chlorophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG03)**. (Yield: 79%); mp 181-182 ˚C; IR (KBr, ν, cm^{-1}): 3253 (N-H), 3051 (-CH_3), 1714/1670 (C=O), 1592 (ArC=N), 1460 (NH), 749 (C-Cl); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.36 (t, 3H, CH_3), 1.76 (q, 2H, -CH_2-), 2.78 (1H, NH), 4.05 (t, 2H, CH_2N), 4.22 (t, 2H, -CH_2-O), 4.58 (s, 2H, N-CH_2-CO), 6.82-8.52 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 9.71 (-CH_3), 19.22 (-CH_2-), 41.55 (-CH_2-N), 49.52 (N-C-CO), 65.03 (-CH_2-O), 114.17 (Ar C2/C6), 121.14 (Ar C4), 129.36 (Ar C3/C5), 135.98 (Ar C1), 121.53 (Ar C2), 128.85 (Ar C3), 129.36 (Ar C4), 124.915 (Ar C5), 121.14 (Ar C6), 149.65 (C=N), 157.80 (CON), 165.18 (CO); MS (ESI): m/z (%) 401.09 ([M+1]. Anal. Calcd. (%) for $C_{20}H_{21}ClN_4O_3$: C, 59.92; H, 5.28; Cl, 8.84; N, 13.98; O, 11.37.

2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]-*N*-(4-fluoro-phenyl)acetamide (KJSSCDG04). (Yield: 71%); mp 199-200 ˚C; IR (KBr, ν, cm^{-1}): 3579 (-CH_3), 3251 (N-H), 3057 (-CH_3), 1712/1666 (C=O), 1547 (ArC=N), 1471 (NH), 1235 (C-F); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.34 (t, 3H, CH_3), 1.71 (q, 2H, -CH_2-), 2.77 (1H, NH), 4.05 (t, 2H, CH_2N), 4.22 (t, 2H, -CH_2-O), 4.60 (s, 2H, N-CH_2-CO), 6.82-8.04 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 9.71 (-CH_3), 19.22 (-CH_2-), 41.55 (-CH_2-N), 49.52 (N-C-CO),

65.03 (-CH_2-O), 114.17 (Ar C2/C6), 121.14 (Ar C4), 129.36 (Ar C3/C5), 135.98 (Ar C1), 121.53 (Ar C2), 128.85 (Ar C3), 129.34 (Ar C4), 128.85 (Ar C5), 112.82 (Ar C6), 149.65 (C=N), 157.80 (CON), 165.18 (CO); MS (ESI): m/z (%) 401.13 ([M+1]. Anal. Calcd. (%) for $C_{21}H_{23}FN_4O_3$: C, 63.30; H, 5.82; F, 4.77; N, 14.07; O, 12.05.

***N*-(4-bromophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG05)**. (Yield: 80%); mp 204-205 ˚C; IR (KBr, ν, cm^{-1}): 3247 (N-H), 3049 (-CH_3), 1673 (C=O), 1535 (ArC=N), 1467 (NH), 1236 (C-Br); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.36 (t, 3H, CH_3), 1.76 (q, 2H, -CH_2-), 2.78 (1H, NH), 4.05 (t, 2H, CH_2N), 4.22 (t, 2H, -CH_2-O), 4.58 (s, 2H, N-CH_2-CO), 6.82-8.52 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 9.73 (-CH_3), 19.19 (-CH_2-), 41.49 (-CH_2-N), 49.49 (N-C-CO), 65.01 (-CH_2-O), 114.15 (Ar C2/C6), 121.40 (Ar C4), 129.58 (Ar C3/C5), 136.51 (Ar C1), 131.74 (Ar C2), 129.597 (Ar C3), 149.53 (C=N), 157.78 (CON), 165.21 (CO); MS (ESI): m/z (%) 455.31 ([M+1]. Anal. Calcd. (%) for $C_{20}H_{21}BrN_4O_3$: C, 53.94; H, 5.75; Br, 17.94; N, 12.58; O, 10.78.

2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]-*N*-phenyl-acetamide (KJSSCDG06). (Yield: 82%); mp 206-207 ˚C; IR (KBr, ν, cm^{-1}): 3242 (N-H), 3048 (-CH_3), 1720/1663 (C=O), 1552 (ArC=N), 1467 (NH); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.33 (t, 3H, CH_3), 2.73 (1H, NH), 4.19 (t, 2H, -CH_2-O), 4.49 (s, 2H, N-CH_2-CO), 6.75-8.36 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 11.26 (-CH_2-), 32.89 (-CH_2-N), 47.81 (N-C-CO), 68.61 (-CH_2-O), 113.37 (Ar C2/C6), 121.56 (Ar C4), 141.96 (Ar C1), 131.92 (Ar C3), 123.42 (Ar C5), 149.92 (C=N), 157.57 (CON); MS (ESI): m/z (%) 417.09 ([M+1]. Anal. Calcd. (%) for $C_{24}H_{24}N_4O_3$: C, 69.21; H, 5.81; N, 13.45; O, 11.52.

***N*-(4-methoxy-2-nitrophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG07)**. (Yield: 78%); mp 103-105 ˚C; IR (KBr, ν, cm^{-1}): 3357 (N-H), 3009 (-CH_3), 1738 (C=O), 1576 (ArC=N), 1437 (NH), 1216 (O-CH_3); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.33 (t, 3H, CH_3), 2.73 (1H, NH), 4.19 (t, 2H, -CH_2-O), 4.49 (s, 2H, N-CH_2-CO), 6.75-8.38 (m, 8H, Ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 1.73 (-CH_3), 11.27 (-CH_2-), 33.27 (-CH_2-N), 41.81 (N-C-CO), 68.67 (-CH_2-O), 113.57 (Ar C2/C6), 121.74 (Ar C4), 141.94 (Ar C1), 130.51 (Ar C3), 149.92 (C=N), 157.57 (CON); MS (ESI): m/z (%) 411.93 ([M+1]. Anal. Calcd. (%) for $C_{20}H_{21}N_5O_5$: C, 58.39; H, 5.14; N, 17.02; O, 19.44.

***N*-(3-nitrophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG08)**. (Yield: 75%); mp 160-161 ˚C; IR (KBr, ν, cm^{-1}): 3264 (N-H), 2993 (-CH_3), 1722/1667 (C=O), 1593 (ArC=N), 1468 (NH), 1536 (-NO_2); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.37 (t, 3H, CH_3), 2.29 (q, 2H, -CH_2-), 2.77 (1H, NH), 4.05 (t, 2H, CH_2N), 4.21

(t, 2H, -CH_2-O), 4.56 (s, 2H, N-CH_2-CO), 6.84-8.40 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 9.75 (-CH_3), 19.25 (-CH_2-), 41.55 (-CH_2-N), 49.55 (N-C-CO), 65.09 (-CH_2-O), 114.21 (Ar C2/C6), 120.11 (Ar C4), 129.41 (Ar C3/C5), 134.21 (Ar C1), 129.64 (Ar C3), 121.52 (Ar C6), 149.70 (C=N), 157.88 (CON), 165.01 (CO); MS (ESI): m/z (%) 412.16 ([M+1]. Anal. Calcd. (%) for $C_{21}H_{23}N_5O_5$: C, 59.29; H, 5.45; N, 16.46; O, 18.80.

***N*-(4-nitrophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG09)**. (Yield: 72%); mp 189-190 ˚C; IR (KBr, ν, cm^{-1}): 3260 (N-H), 3046 (-CH_3), 1715/1665 (C=O), 1545 (ArC=N), 1455 (NH), 1507 (-NO_2); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.37 (t, 3H, CH_3), 2.75 (q, 2H, -CH_2-), 2.78 (1H, NH), 4.05 (t, 2H, CH_2N), 4.21 (t, 2H, -CH_2-O), 4.56 (s, 2H, N-CH_2-CO), 6.84-8.41 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 2.71 (-CH_3), 12.20 (-CH_2-), 34.49 (-CH_2-N), 48.38 (N-C-CO), 69.64 (-CH_2-O), 114.46 (Ar C2/C6), 120.57 (Ar C4), 114.46 (Ar C3), 122.527 (Ar C6), 149.49 (C=N), 157.92 (CON); MS (ESI): m/z (%) 412.16 ([M+1]. Anal. Calcd. (%) for $C_{21}H_{23}N_5O_5$: C, 59.29; H, 5.45; N, 16.46; O, 18.80.

***N*-(2-nitrophenyl)-2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1*H*-1,2,4-triazol-1-yl]acetamide (KJSSCDG10)**. (Yield: 70%); mp 194-195 ˚C; IR (KBr, ν, cm^{-1}): 3253 (N-H), 3051 (-CH_3), 1722/1664 (C=O), 1552 (ArC=N), 1462 (NH), 1504 (-NO_2); ^{1}H-NMR (DMSO-d_6) δ (ppm): 1.42 (t, 3H, CH_3), 2.80 (q, 2H, -CH_2-), 2.81 (1H, NH), 4.07 (t, 2H, CH_2N), 4.23 (t, 2H, -CH_2-O), 4.72 (s, 2H, N-CH_2-CO), 6.82-8.87 (m, 8H, ar-H, phenyl); ^{13}C-NMR (DMSO-d_6) δ (ppm): 12.29 (-CH_2-), 34.89 (-CH_2-N), 42.35 (N-C-CO), 58.63 (-CH_2-O), 114.86 (Ar C2/C6), 122.85 (Ar C4), 121.64 (Ar C3), 150.75 (C=N), 158.65 (CON); MS (ESI): m/z (%) 412.16 ([M+1]. Anal. Calcd. (%) for $C_{21}H_{23}N_5O_5$: C, 59.29; H, 5.45; N, 16.46; O, 18.80.

Antimicrobial activities by Disc Diffusion Method:

The antimicrobial susceptibility testing using the disc diffusion method was conducted in accordance with the established protocol outlined by Bauer *et al*. (1966) to evaluate the potential antibacterial properties of the plant extracts. The bacterial culture, which was standardised to a 0.5 McFarland standard, was employed to uniformly spread across Muller Hinton agar plates using a sterile brush. The plates were allowed to air dry for a duration of 15 minutes before being utilised in the sensitivity test. The discs that were saturated with a sequence of botanical extracts were positioned on the surface of the Mueller-Hinton agar. Each test plate consists of six discs. The experimental setup consisted of one positive control, represented by a regular commercial antibiotic disc, one negative control, and four treated discs. The antibiotic discs used in this study were *Chloramphenicol* for *B. subtilis,* and *P.*

aeruginosa was employed. The negative control used in the experiment consisted of dimethyl sulfoxide (DMSO) at a concentration of 100%. In addition to the control group, each plate was equipped with four treated discs that were evenly spaced apart. Subsequently, the plate was subjected to incubation at a temperature of 37°C for a duration ranging from 18 to 24 hours, contingent upon the specific bacterial species employed in the experiment. Following the incubation period, the plates were assessed for the presence of an inhibitory zone. The measurement of the inhibitory zone was then conducted using callipers and documented. The experiment was conducted in triplicate to confirm the trustworthiness of the results.

Results and Discussion:

Multi-component (one-pot) synthesis of 2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1H-1,2,4-triazol-1-yl]-N-phenylacetamides derivatives are reported in the presence of sodium hydroxide. In the present study, we synthesised 2-[3-ethyl-5-oxo-4-(2-phenoxyethyl)-4,5-dihydro-1H-1,2,4-triazol-1-yl]-N-phenylacetamides derivatives by reacting 5-ethyl-4-(2-phenoxyethyl)-2,4-dihydro-3H-1,2,4-triazol-3-one with corresponding 2-chloro-N-phenylacetamide in the presence of sodium hydroxide at 75-80 °C for 12 h.

At 75-80 °C, 1.0 equivalent of corresponding 2-chloro-N-phenylacetamide are added to equimolar amounts of 5-ethyl-4-(2-phenoxyethyl)-2,4-dihydro-3H-1,2,4-triazol-3-one and sodium hydroxide, and the mixture is agitated for 12 h. After 25-30 minutes of stirring, TLC was used to check the reaction's development. The anticipated outcomes manifested as filtered precipitates. The precipitates formed were washed in an organic solvent for clean materials (**Scheme 1**). Spectroscopic investigations shed light on the structures of the pure products.

General structure elucidation:

FT(IR) Spectra:

Compounds (**KJSSCDG01-10**) FT(IR) spectra show the stretching vibration over the 3242-3387 cm^{-1} range. This stretching vibration is one of the several low-intensity absorption peaks associated with aliphatic-NH. The aliphatic-CH_3 stretching vibration of these molecules can be seen at 2985-3072 cm^{-1} in the high-frequency part of its infrared spectrum. The 1664-1738 cm^{-1} absorption peak has been attributed to the methyl group accompanying bending vibration. As a result, the stretching vibration connected to the amino group brings the absorption peak in the 1437–1593 cm^{-1} region. The stretching vibration of the aromatic C=N group is responsible for the significant absorption that may be observed between 1535 and 1593 cm^{-1}. Because of the aromatic ring's *ortho*, *meta*, and *para*-chloro groups, compounds **KJSSCDG01**, **KJSSCDG02**, and **KJSSCDG03** showed different absorption bands in their

own IR spectra at about 752, 746, and 749 cm^{-1}, respectively. The prominent bands at 1504-1536 cm^{-1} most clearly identify the FT-IR spectra of the compounds **KJSSCDG09-10**. These band intensities match the aromatic ring stretching frequencies of the methoxy groups. The molecules in **KJSSCDG04** and **KJSSCDG05** exhibited peaks in their FT-IR spectra at 1235 and 1236 cm^{-1}, respectively. The fluoro and bromo groups can be attributed to these two peaks.

^{1}H NMR Spectra:

We understand from the chemical structure that various carbon couplings are connected to identical protons. In the ^{1}H NMR spectra of compound **KJSSCDG01-10**, these chemically similar protons were detected at 2.73-2.81 ppm, assigned as aliphatic secondary amine. The proton of the aliphatic methyl group was discovered to have a singlet with a frequency range of 1.27-1.42 ppm. The observed ppm of protons in -CH_2-, -CH_2-N, -CH_2-O, and N-CH_2-CO ranged from 1.71-2.80, 4.05-4.17, 4.19-4.23 and 4.49-4.61ppm respectively. The aromatic ring protons were a multiplet with a frequency range of 6.77-8.87 ppm.

^{1}H NMR Spectra:

The compounds **KJSSCDG01-10**'s ^{13}C NMR spectra exhibit signals of δ1.73–9.76 that suggest a monosubstituted methyl unit. The -CH_2- carbon can be found in the range of δ11.26 to 19.34. Since the aromatic ring's carbon atoms are incomparable, synthesised compounds exhibit nine signals between δ113 and δ141. Derivatives **KJSSCDG01-10**'s methoxy group carbon atoms were found in the range δ56.1–57.5. Due to sp^2 hybridisation and the double bond to oxygen, the ^{13}C-NMR signals for carbonyl carbons are seen in the range 165.01-165.33 ppm. The experimental part contains all the spectroscopic information for every chemical compound.

Antimicrobial Activity:

All the prepared compounds (**KJSSCDG01-10**) were evaluated against *Bacillus subtilis* NCIM 2250 (Gram-positive Bacteria) and *Pseudomonas aeruginosa* NCIM 2036 (Gram-negative Bacteria) by the Agar diffusion assay (Disc diffusion method), and the results are shown in **Table 1**. The disc diffusion method was used to test the newly synthesised compounds **KJSSCDG01-10** for antibacterial activity. Using a microwell plate, we generated nutrient broth and inoculum and tested chemical mixtures at final concentrations of 3000, 2000, 1000, 500, and 250 μg/mL using the broth dilution method. A test substance's minimal effective concentration (MIC) s the concentration at which growth inhibition is observed. Inhibitory zones against Pseudomonas aeruginosa were large for all drugs when they were dissolved in DMSO. When compared to **KJSSCDG02, KJSSCDG05, KJSSCDG06, KJSSCDG07**, and

KJSSCDG08, the **KJSSCDG01, KJSSCDG03, KJSSCDG04, KJSSCDG09**, and **KJSSCDG10** compounds showed significantly higher levels of activity. Only **KJSSCDG10** demonstrated a significant inhibitory zone in DMSO, whereas the other 9 drugs had no impact. With B. subtilis, we saw the opposite trend. Inhibition of this Gram-positive bacteria by the DMSO-extracted chemicals was unsuccessful.

Table 1: Antimicrobial activities of compounds KJSSCDG01-10

Sr. No.	***Sample code***	***Bacillus subtilis***	***Pseudomonas aeruginosa***	***Saccharomyces cerevisiae***
1	KJSSC DG-01	9.05	11.12	8.44
2	KJSSC DG-02	8.22	8.25	8.14
3	KJSSC DG-03	11.22	9.04	8.03
4	KJSSC DG-04	9.23	9.14	10.48
5	KJSSC DG-05	7.05	11.44	-
6	KJSSC DG-06	7.22	7.12	7.02
7	KJSSC DG-07	9.48	7.25	9.68
8	KJSSC DG-08	-	9.11	-
9	KJSSC DG-09	8.14	7.04	10.47
10	KJSSC DG-10	10.44	9.55	11.22
Control	Chloramphenicol	26.12	25.88	NA
Control	Amphotericin B	NA	NA	18.19

Zone diameter in mm calculated by Vernier Caliper '-' means no zone of inhibition, NA Not applicable.

Conclusion:

Ten compounds were developed and evaluated for their ability to eliminate gram-positive efficiently (*Bacillus subtilis* NCIM 2250) and gram-negative (*Pseudomonas aeruginosa* NCIM 2036) bacteria and fungi (*Saccharomyces cerevisiae* NCIM 3321). After 24 hours of incubation for antibacterial activities and 48 hours for antifungal activities, the zones of inhibition produced around the cup were observed, and the minimum inhibitory concentrations (MIC) of all the compounds were calculated. The antibacterial activity of the compounds was determined to be moderate.

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