Synthesis and characterization of some novel 2-{2-[1-(3-substituted-phenyl)-1*H*-1,2,3-triazol-4-yl-] ethyl}-1-substituted-1*H*-benzo [*d*] imidazole derivatives

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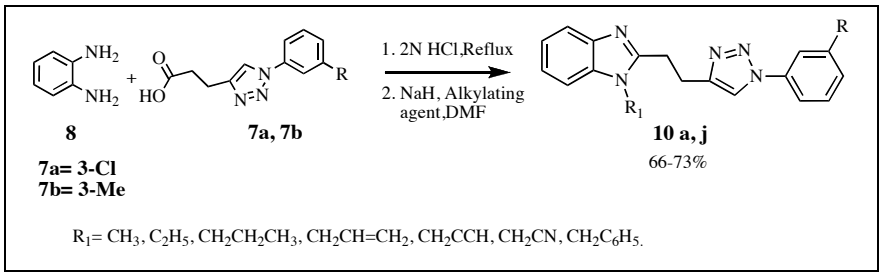

Synthesis of some novel 2-{2-[1-(3-substitutedphenyl)-1*H*-1,2,3-triazol-4-yl-]ethyl)-1*H*-benzo[*d*]-imidazole derivatives, by the condensation of o-phenylenediamine with 3-(1-(3-substituted-phenyl)-1*H*-1,2,3-triazol-4-yl) propanoic acid and then subsequent reactions with different substituted alkyl halides as electrophiles are mentioned. The synthesized compounds were characterized by ^{1}H NMR, EI-MS and IR spectroscopic techniques.

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INTRODUCTION

N-Heterocyclic compounds are broadly distributed in nature including amino acids, purines, pyrimidines and many other natural products. Triazoles, like many other five membered heterocyclic compounds are used very often in pharmaceutical and medicinal applications. N-Heterocyclic species having 1,2,3-triazole ring system exhibits numerous example of activities in the literature including anti-HIV activity [1], antimicrobial activity against gm positive bacteria [2], inhibition of histidine biosynthesis [3], ß-selective adrenergic receptor activity agonist [4], bacterial and medicinal fungicides of second generation [5], Anti-inflammatory agents [6]. In addition to this, 1,2,3 -triazoles have found broad applications in agrochemicals as fungicides and plant growth regulators as well as industrial applications in dyes, corrosion inhibition (of copper and copper alloys) and photostabilizers [7].

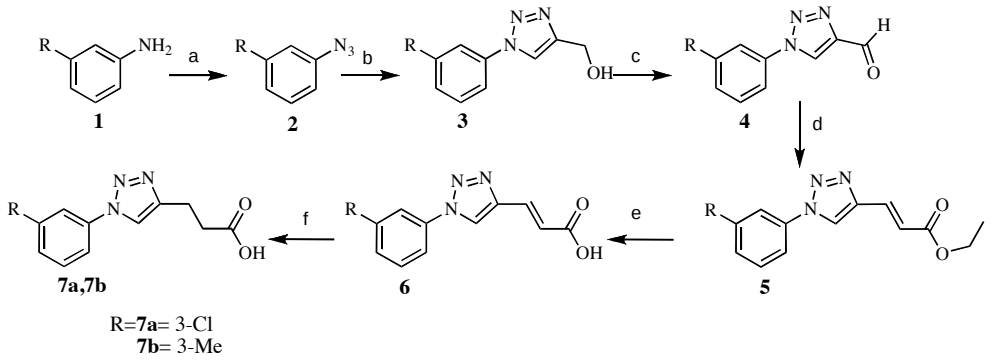
In continuation, benzimidazole nucleus is a constituent of many of the bioactive heterocyclic compounds that exhibit a range of biological activities. Especially the nucleus is a constituent of vitamin B_{12} [8]. Benzimidazole derivatives have received much interest in the field of medicinal chemistry because of its synthetic utility and broad-spectrum pharmacological activity. Various benzimidazole moieties are known to have varied biological activities such as anti-HIV, herpes, RNA influenza and cytomegalovirus [9], antiviral, antibacterial, antihypertension, antiulcer *etc* [10], antibacterial and antifungal [11], human and veterinary anthelmintic [12], cardiotonic [13]. In this case, 2-substituted benzimidazoles are found to more potent so it would be worthwhile to design and synthesize 2-substituted benzimidazole [14]. We were interested to introduce a 2-carbon side-chain in between 1,2,3-triazole and benzimidazole in order to see the effect of this group on biological activity at 2-position [15].

Looking at the biological importance of benzimidazoles and heterocyclic species having 2-carbon chain 1,2,3-triazoles in biological systems, at present the studies on triazole as the only active groups and other active group like benzimidazole in a single molecule has rarely been found. Owing to the immense importance and versatile bioactivities exhibited by benzimidazoles and 1,2,3-triazole derivatives, efforts have been made from time to time to generate libraries of these compounds and screened them for potential biological activities. In this paper, we report the synthesis and characterization of novel 1,2,3-triazole containing benzimidazole derivatives only.

RESULTS AND DISCUSSION

Diazotization of substituted aromatic amines with sodium nitrite in hydrochloric acid and the resulting reaction of diazonium salt with sodium azide to give the

Scheme 1



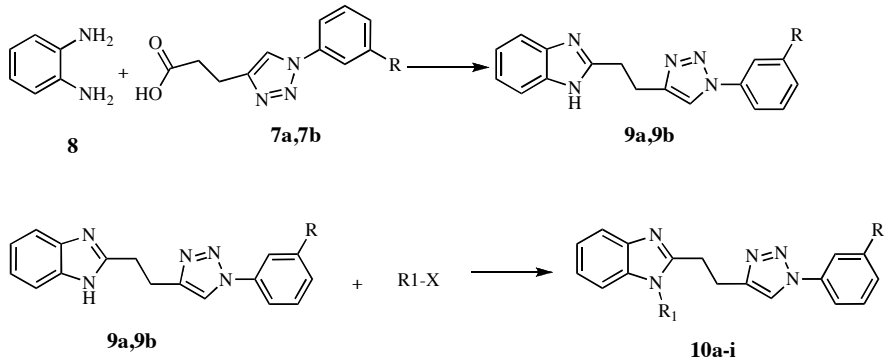
a: $NaNO_2$.HCl, NaN_3, H_2O, 0 °C; b: Propargyl alchohol, CuI, Acetonitrile, RT; C: Dess-martin periodinanane, DCM, RT; d: Triethyl-phosphonoacetate, TEA, LiBr, Acetonitrile; e: LiOH, THF-ETOH-H_2O, RT; f: 10% Pd/C, H_2, THF.

azido-benzenes [16]. Several methods have been described for the synthesis of 1,2,3-triazoles recently; especially the copper catalyzed addition of organo-azide to terminal alkynes has become a useful and widely applicable method for the synthesis of 1,2,3-triazoles [17]. Azido benzene was then treated with propargyl alcohol in the presence of copper iodide at room temperature to give [1-(3-substituted-phenyl-1*H*-1,2,3-triazol-4-yl)]-methanol [18], which was then converted into aldehyde compound at room temperature by using Dess-Martin periodinane as an oxidizing agent [19]. Then the aldehyde intermediate reacts with triethyl phosphonoacetate under Wittig reaction conditions, gives (*E*)-3-[1-(3-substituted-phenyl)-1*H*-1,2,3-triazol-4-yl]-acrylic acid ethyl ester, which was then hydrolyzed with lithium hydroxide in THF-EtOH-H_2O to the acid product. In the final stage, catalytic hydrogenation of (*E*)-3-(1-(3-substituted-phenyl)-1*H*-1,2,3-triazol-4-yl) acrylic acid, gives 3-[1-(3-substituted-phenyl)-1*H*-1,2,3-triazol-4-yl]propanoic acid. By this reaction sequence, we have synthesized 3-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] propanoic acid **7a** and 3-[1-(*m*-tolyl)-1*H*-1,2,3-triazol-4-yl] propanoic acid **7b**. (Scheme 1)

Condensation of *o*-phenylenediamine (OPDA) (**8**) with 3-[1-(3-chloro-phenyl)-1*H*-1,2,3-triazol-4-yl]-propanoic acid (**7a**) in refluxing 2 *N* HCl *(Phillips conditions)* [20] for 3-4 hr (Scheme 2), followed by simple work-up yielded a brownish colour compound having mp 80-82 °C and in 76% yield. Based on the observed spectral and analytical data, the compound was assigned the structure as 2-{2-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl]-ethyl}-1*H*-benzo[*d*] imidazole (**9a**). Similarly, 2-{2-[1-(*m*-tolyl)-1*H*-1,2,3-triazol-4-yl]-ethyl}-1*H*-benzo[*d*]-imidazole (**9b**) was also synthesized by the condensation of **8** with **7b** in the presence of *Eaton's reagent* [21] (1:10 mixture of phosphorous pentoxide/methanesulfonic acid) an efficient and convenient alternative to polyphosphoric acid (PPA) [22] for cyclodehydration reaction.

The alkylation reaction of **9a, 9b** with various electrophilic reagents yielded the N-alkylated derivatives (Scheme 2). These compounds have been synthesized and characterized by spectral and analytical data. The physical and spectral data of these compounds are presented below.

Scheme 2



R_1= CH_3, C_2H_5, $CH_2CH_2CH_3$, $CH_2CH{=}CH_2$, CH_2CCH, CH_2CN, $CH_2C_6H_5$

EXPERIMENTAL

Melting points were estimated by Veggo programmable (microprocessor based) melting point apparatus, are uncorrected. The analysis was done using precoated silica gel plates and visualization was done using Iodine and UV lamp. IR spectra were recorded on (KBr disc) using a FTIR bruker Vector 22 Spectrophotometer. ^{1}H NMR spectra recorded on Varian 400 MHz spectrometer. Elemental analyses were determined on Elementor Vario CHN analyser instrument. EI-MS spectra recorded on micromass-quatro –II. All the reagents, solvents used were of commercial grade only.

Experimental procedure for the preparation of 3-(1-(3-substituted-phenyl)-1*H*-1,2,3-triazol-4-yl) propanoic acid (7a and 7b). To a Solution of 3-chlorobenzenamine **1a** (5.0 g, 39 mmol) dissolved in 50 mL HCl: H_2O (1:1) was cooled at -5°C by ice-salt mixture. Then a solution of sodium nitrite (5.4 g, 78.7 mmol) dissolved in water (15 mL) was added slowly at -5°C. After completion of addition, the reaction mixture was stirred at -5°C for 60 min. Then the reaction mixture was neutralized with sodium acetate (67.7g 787mmol). Following this, a solution of NaN_3 (5.11g 78.6mmol) in water (15 mL) was added slowly over the period of 30 min by maintaining the temp at -5 °C to 0 °C. After stirring for 30 min, the solution was allowed to warm at room temperature. Extracted with ethyl acetate (100 mL x 2), dried the organic layer over sodium sulphate and evaporated to yield 1-azido 3-chloro benzene **2a** as an oily product (5.7 g).

In the second stage, 1-azido 3-chloro-benzene **2a** (5.7 g, 37mmol) was dissolved in acetonitrile (25 mL). Propargyl alcohol (4.17g, 74 mmol) and copper iodide (1.4 g, 7 mmol) were added to the above reaction mixture. The reaction mixture was stirred at room temperature for 8-10 hrs, a solid material separated out, was filtered, and dried by suction. Off-white solid obtained as [1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] methanol **3a** (6.8 g).

In the third stage, a solution of [1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] methanol **3a** (6.8 g, 32 mmol) in dichloromethane (35 mL) was added a Dess- Martin Periodinane solution in DCM (21.0 g, 49 mmol), at room temperature Reaction mixture was stirred for 4-5 hrs at room temperature. After completion of reaction, aq. solution of 10% sodium bicarbonate and sodium thiosulphate (1:1) was added to the reaction mixture, organic layer separated and dried over sodium sulphate and evaporated to yield the 1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-carbaldehyde **4a** (4.8 g).

In the fourth stage, to solution of 1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-carbaldehyde **4a** (4.8 g, 23 mmol) in THF (50 mL) at room temperature was added LiBr (3.02 g, 35 mmol), triethylamine (4.8 mL, 34 mmol), triethyl phosphonoacetate (5.71 g, 25 mmol) and stirred at room temperature for 8-10 hrs. Then the reaction mixture quenched with water (100 mL) and extracted with ethyl acetate (50 mL x 2), dried the organic layer over sodium sulphate and concentrated under vacuum and yielded (*E*)-ethyl 3-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] acrylate **5a** (4.5 g).

In the penultimate stage, to a solution of (*E*)-ethyl 3-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] acrylate **5a** (4.5 g, 16 mmol) in THF: EtOH: H_2O (7:2:1) was added $LiOH.H_2O$ (1.02 g, 24 mmol). The reaction mixture stirred at room temperature for 10 hrs. Then charged water (30 mL) to the reaction mixture and adjusted P^H to 6.0 by 10 % HCl, a solid material separated out, was collected by filtration, and dried by suction. A crude solid was triturated with diethyl ether (15 mL) to obtain free solid as (*E*)-ethyl 3- [1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] acrylic acid **6a** (3.0 g).

In the final stage, 10 % Pd/C (0.3 g) was added to the solution of (*E*)-ethyl 3-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] acrylic acid **6a** (3.0 g 0.012mol) in THF. H_2 was bubbled at 50 psi in parr hydrogenator at room temperature for 5-6 hrs. The reaction mixture was filtered through celite and concentrated under vacuum to obtain 3-(1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl) propanoic acid **7a** (2.1 g) and characterized by spectral data mentioned as follows.

3-[1-(3-Chlorophenyl)-1*H*-1,2,3-triazol-4-yl] propanoic acid 7a shows off white solid, mp 164-166 °C; ^{1H} nmr ($CDCl_3$) at δ 2.65 (2H, t), 2.92 (2H, t), 7.51 (1H,m), 7.60 (1H,t), 7.83 (1H,m), 7.99 (1H,m), 8.65 (1H,m), 12.2 (1H,s, -COOH); ms: m/z $C_{11}H_{10}N_3O_2Cl$ 252 (M^+).

3-[1-(*m*-Tolyl-1*H*-1,2,3-triazol-4-yl] propanoic acid 7b was synthesized similarly, from *m*-toluidine **1b**, as off white solid, mp 146-148 °C; ^{1}H nmr ($CDCl_3$) at δ 2.38 (Ar-CH_3 3H, s), 2.65 (2H, t), 2.92 (2H, t), 7.26 (1H,m), 7.43 (1H,t), 7.61 (1H,m), 7.69 (1H,m), 8.52 (1H,s), 12.18 (1H,s, -COOH); ms: m/z $C_{12}H_{13}N_3O_2$ 232 (M^+).

General experimental procedure for the preparation of 2-{2-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl]-ethyl)-1*H*-benzo-[*d*]-imidazole (9a): *Phillips conditions*. To a mixture of a 3-(1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl) propanoic acid **7a** (9.25 mmol) and 1,2 phenylenediamine **8** (9.25 mmol) in 2N HCl (5mL), was refluxed at 110°C for 4-5 hrs and TLC monitored the reaction. After completion of reaction, the reaction mass cooled at room temperature and then neutralized with saturated bicarbonate solution (10% solution), stirred for 15-20 min. The solid material filtered through buchner funnel and washed with water. The obtained solid was triturated with diethyl ether and filtered to yield a pale yellow coloured pure crystalline solid **9a**. (72 % yield) The physical and spectral data of the compounds was mentioned as The compound was obtained as a brownish yellow solid having yield 72.5% (diethyl ether); mp 80-82 °C; ir (KBr): 3276, 3125, 2937, 1703, 1624, 1594, 1491, 1438, 1229, 1049, 785, 742 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 3.38 (2H, t), 3.48 (2H, t), 7.28 (2H, m), 7.44 (2H, m), 7.53 (1H, m), 7.6 (1H, m), 7.68 (2H, m), 7.97 (1H, s), 12.19 (1H, s -NH); ms: m/z 324.1 (M^+); Anal. Cald. for $C_{17}H_{14}ClN$: C, 63.06; H, 4.36; N, 21.63; Found C, 63.19; H, 4.51; N, 21.75.

Preparation of (9b) from (8): General experimental procedure for the preparation of 2-{2-[1-(*m*-tolyl-1*H*-1,2,3-triazol-4-yl]-ethyl)-1*H*-benzo[*d*]-imidazole (9b): Eaton's reagent. A mixture of *o*-phenylenediamine **8** (9.25 mmol), 3-(1-*m*-tolyl-1*H*-1,2,3-triazole-4-yl)-propanoic acid **7b** (9.25 mmol) and P_2O_5/ MSA (15 mL) (1:10 mixture) was refluxed in an oil bath for 3-4 hrs (as monitored by TLC). The reaction mixture was then cooled to room temperature and quenched with aqueous sodium bicarbonate solution till neutral pH and extracted with ethyl acetate (2x 50 mL). The organic layer was washed with water (2 x 30 mL), brine (2x 25 mL) and dried over anhydrous sodium sulphate and distilled to get compound **9b** (75 % yield), which was recrystallised from aqueous ethanol to yield pale yellow coloured pure crystalline solid. The physical and spectral data of the compounds was mentioned as the compound was obtained as a cremish yellow solid having yield 73.0% (aq. ethanol); mp 120-122 °C; ir (KBr): 3377, 3061, 2926, 2858, 1614, 1593, 1536, 1424, 1272, 1129, 1055, 850, 784, 742 cm^{-1};

^{1}H nmr: (400 MHz, $CDCl_3$- d_1): δ 2.44 (3H, s), 3.32 (2H, t), 3.46 (2H, t), 7.21 (2H, m), 7.36-7.40 (2H, m), 7.45 (1H, m), 7.52 (1H, m), 7.63 (2H, m), 7.76 (1H, s), 12.19 (1H,s -NH); ms: m/z $C_{18}H_{17}N_5$ 304.1 (M^+); *Anal*. CHN: Cald. C, 71.27; H, 5.65; N, 23.09; Found C, 70.98; H, 5.79; N, 23.49.

General experimental procedure: Preparation of (10a-f) from (9a) and Preparation of (10g-i) from (9b). Under nitrogen atmosphere, to a solution of sodium hydride (1.1eq) in dimethyl formamide was added, 2-{2-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl] ethyl)-1*H*-benzo[*d*]-imidazole (1.0 eq) the reaction mixture was stirred at room temperature for 30 min. To this reaction mixture was charged alkyl or aryl halides (1.2 eq) at same temp and stirred for 30 min. After completion of reaction, the reaction mass was quenched in ice water, the solid product precipitates out and was collected by filtration, and dried by suction. The obtained solid was triturated with diethyl ether and filtered to yield a pure crystalline solid. (Yield=66-73%). The physical and spectral data of the compounds is presented below.

2-{2-[1-(3-Chlorophenyl)-1*H*-1,2,3-triazol-4-yl]-ethyl}-1-methyl-1*H*-benzo[*d*]imidazole (10a). The compound was obtained using iodomethane as a buff coloured solid having yield 67.2% (Recrystallized by diethyl ether); mp 78-80 °C; ir (KBr): 3133, 2933, 2714, 2608, 2361, 1701, 1632, 1443, 1358, 1231, 846, 718, 690 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 3.47 (2H, t), 3.54 (2H, t), 3.79 (3H, s, N-CH_3) 7.29 (3H,m), 7.37 (1H, m), 7.41 (1H, m), 7.54 (1H, m), 7.72 (1H, m), 7.77 (1H, m), 7.91 (1H, s); ms: m/z 338.1 (M^+) *Anal*. Cald for $C_{18}H_{16}ClN_5$: C, 64.00; H, 4.77; N, 20.73; Found C, 63.94; H, 4.67; N, 20.52.

2-{2-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl]-ethyl}-1-ethyl-1*H*-benzo[*d*]imidazole (10b). The compound was obtained using iodoethane as a off-white solid having yield 69.5%(Diethyl ether); mp 88-90 °C; ir (KBr): 3280, 3128, 2361, 1623, 1540, 1492, 1440, 1273, 1230, 1051, 785, 680 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 1.38 (3H, t), 3.36 (2H, t), 3.49 (2H, t), 4.19 (2H, q,) 7.22 (1H, m), 7.29 (1H, m), 7.39 (2H, m), 7.54 (1H, m), 7.73 (2H, m) 7.77 (1H, m), 7.79 (1H, s); ms: m/z 352.2 (M^+); *Anal*. Cald. for $C_{19}H_{18}ClN_5$: C, 64.86; H, 5.16; N, 19.90; Found C, 64.49; H, 4.98; N, 19.75.

2-{2-[2-(1-(3-Chlorophenyl)-1*H*-1,2,3-triazol-4-yl)-ethyl]-1*H*-benzo[*d*]imidazole-1-yl} acetonitrile (10c). The compound was obtained using 2-bromoacetonitrile as a buff coloured solid having yield 73.0% (Diethyl ether); mp 102-104 °C; ir (KBr): 3229, 3134, 2931, 1664, 1595, 1490, 1461, 1232, 1051, 752 cm^{-1}; ^{1}H nmr: (400 MHz, $CDCl_3$): δ 3.42 (4H, s), 5.18 (2H, s), 7.32 (3H, m), 7.39 (1H, m), 7.42 (1H, m), 7.53 (1H, s), 7.69 (1H, m), 7.76 (2H, s); ms: m/z 363.1 (M^+); *Anal*. Cald. for $C_{19}H_{15}ClN_6$ C, 62.90; H, 4.17; N, 23.16; Found C, 63.09; H, 4.16; N, 23.57.

1-Benzyl-2-{2-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl]-ethyl}-1*H*-benzo[*d*]imidazole (10d). The compound was obtained by using 1-bromomethylbenzene as a brownish solid having yield 68.0% (Diethyl ether); mp 116-118 °C; ir (KBr): 3152, 2954, 2751, 2450, 2361, 2238, 1575, 1466, 1378, 1222, 779, 742 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 3.27 (2H, t), δ 3.41 (2H, t), 5.39 (2H, s), 7.00 (2H, m), 7.32 (3H, m), 7.4 (4H, m), 7.42-7.5 (2H, m), 7.69 (2H, m), 7.81 (1H, s); ms: m/z 414.1(M^+); *Anal*. Cald. for $C_{24}H_{20}ClN_5$: C, 69.64; H, 4.87; N, 16.92; Found C, 69.48; H, 4.76; N, 16.72.

2-{2-[1-(3-Chlorophenyl)-1*H*-1,2,3-triazol-4-yl]-ethyl}-1-propyl-1*H*-benzo[*d*]imidazole (10e). The compound was obtained using 1-bromopropane as a pale yellow solid having yield 68.7% (Diethyl ether); mp 82-84 °C; ir (KBr): 3135, 2966, 2874, 2634, 2362, 1596, 1464, 1419, 1332, 1227, 1047, 789, 742 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 1.14 (2H, t), 2.46 (2H, m), 3.42 (4H, s), 3.67 (2H, t), 7.25 (1H, m), 7.32 (1H, m), 7.40 (2H, m), 7.59 (2H, m), 7.69 (2H, m), 7.77 (1H, m), 7.82 (1H, s); ms: m/z 366.2 (M^+); *Anal*. Cald. for $C_{20}H_{20}ClN_5$: C, 65.66; H, 5.51; N, 19.14; Found C, 65.72; H, 5.36; N, 19.41.

1-Allyl 2-{2-[1-(3-chlorophenyl)-1*H*-1,2,3-triazol-4-yl]-ethyl}-1*H*-benzo[*d*]imidazole (10f). The compound was obtained using 3-bromoprop-1-ene as a pale yellow solid having yield 66.2% (Diethyl ether); mp 72-74 °C; ir (KBr): 3327, 2928, 2714, 2604, 2361, 1628, 1580, 1437, 1312, 1127, 853, 773 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 3.52 (2H, t), 3.64 (2H, t), 4.87 (2H, d), 5.46 (2H, m), 5.88 (1H, m), 7.25 (1H, m), 7.32 (2H, m), 7.40 (2H, m), 7.59 (2H, m), 7.64 (2H, m) 7.70 (1H, m), 7.79(1H, s); ms: m/z 364.1(M^+); Anal. Cald. for $C_{20}H_{18}ClN_5$: C, 66.02; H, 4.99; N, 19.25; Found C, 65.98; H, 5.26; N, 19.41.

1-Methyl-2-{2-[1-(*m*-tolyl-1*H*-1,2,3-triazol-4-yl]-ethyl}-1*H*-benzo[*d*]imidazole (10g). The compound was obtained using iodomethane as a pale yellow colour solid having yield 69.5% (Recrystallized by diethyl ether); mp 94-96 °C; ir (KBr): 3357, 3137, 3095, 1615, 1505, 1450, 1476, 1404, 1238, 1063, 781, 738.cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 2.41 (3H, s), 3.76 (2H, t), 3.82 (2H, t), 4.02 (3H, s), 7.21 (2H,m), 7.35(1H, m), 7.50 (4H, m), 7.97 (1H, m), 8.19 (1H, s); ms: m/z 318.1 (M^+); *Anal*. Cald. for $C_{19}H_{19}N_5$: C, 71.90; H, 6.03; N, 22.06; Found C, 71.89; H, 5.98; N, 21.86.

1-Ethyl-2-{2-[1-(*m*-tolyl-1*H*-1,2,3-triazol-4-yl]-ethyl}-1*H*-benzo[*d*]imidazole (10h). The compound was obtained using iodoethane as a off-white solid having yield (72.1%) (Diethyl ether); mp 70-72 °C; ir (KBr): 3379, 3216, 3139, 3060, 2969, 2926, 1614, 1498, 1420, 1231, 1050, 746, 684 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 1.37 (3H, t), 2.42 (3H, s), 3.36 (2H, t), 3.48 (2H, t), 4.20 (2H, q,) 7.25 (2H, m), 7.33(2H, m), 7.44 (2H, m), 7.75 (2H, m) 7.99 (1H, s). ms: m/z 332.2 (M^+); *Anal*. Cald. for $C_{20}H_{21}N_5$: C, 72.48; H, 6.39; N, 21.13; Found C, 72.49; H, 6.41; N, 20.95;

1-{Prop-2-ynyl}-2-[2-(1-(*m*-tolyl-1*H*-1,2,3-triazol-4-yl)-ethyl]-1*H*-benzo[*d*]imidazole (10i). The compound was obtained using 3-bromoprop-1-yne as a off-white solid having yield 67.0% (Diethyl ether); mp 81-83 °C; ir (KBr): 3379, 3216, 3139, 3060, 2969, 2926, 1614, 1498, 1420, 1231, 1050, 746, 684 cm^{-1}; ^{1}H nmr: (400 MHz, DMSO d_6): δ 2.1 (1H, s), 2.72 (3H, s), 3.38 (4H, t), 3.45 (2H, t), 4.51 (2H, s) 7.29 (2H, m), 7.36 (2H, m), 7.49 (2H, m), 7.81 (2H, m), 7.92 (1H, s). ms: m/z 342.1 (M^+); *Anal*. Cald. for $C_{20}H_{21}N_5$: C, 73.88; H, 5.61; N, 20.51; Found C, 73.49; H, 5.41; N, 20.85;

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