Scientific paper

Construction of Some New Bioactive Building Block of Thiazolidines

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Abstract

An efficient route for the synthesis of new series of *N*-[3-(1*H*-1,2,3-benzotriazol-1-yl)-propyl]-2-(substituted phenyl)-4-oxo-5-(substituted benzylidene)-1,3-thiazolidine-carboxamide has been devised; compounds **5a–j** have been synthesized and characterized by IR, ^{1}H NMR, ^{13}C NMR, FAB-MS and chemical elemental analysis. All final compounds were screened for their antimicrobial activity against some selected bacteria and fungi and antituberculosis study against *Mycobacterium tuberculosis* and antiinflammatory activity on albino rats.

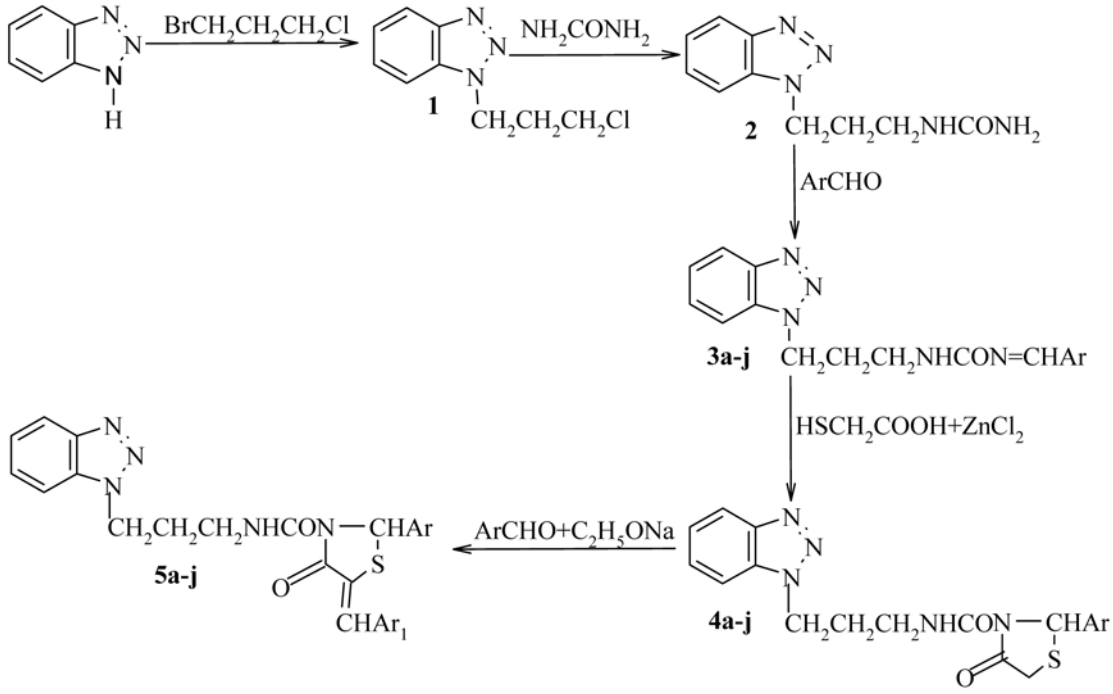
Keywords: Synthesis, benzotriazolo-4-oxo-thiazolidine, antimicrobial, antitubercular, antiinflammatory.

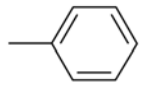
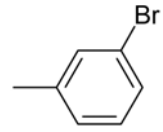
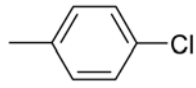
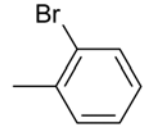
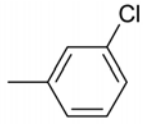
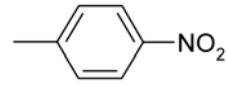
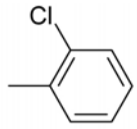
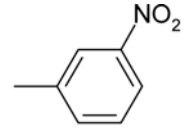
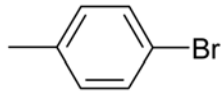
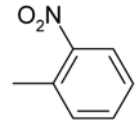
1. Introduction

Heterocyclic compounds have been under investigation for a long time because of their important pharmacological properties. Thiazolidines possess various remarkable biological activities such as antimicrobial,[1] antibacterial,[2,3] antifungal,[4] antipsychotic,[5] antiviral,[6] antitubercular,[7] anticancer[8] and anti-HIV.[9] 1,2,3-Benzotriazole derivatives have been a topic of a substantial research interest and continue to be one of the most active areas of heterocyclic chemistry, particularly due to their natural occurrence and pharmacological activities. The large numbers of benzotriazoles are at the fore as pharmacologically active leads compounds for drug development. Benzotriazoles also occur widely in many natural products such as those from plants, fungi and marine organism. The biological and chemical properties of the benzotriazoles have attracted the attention of organic and medicinal chemists, biologists and pharmacists. Chemical and biological research has also presented a great challenge to synthesize and optimize highly efficient and economical synthetic routes to novel biologically active substances. At present there are thousands of compounds described, which include simple and more complexly substituted benzotriazoles. The simple benzotriazoles are comprised of triazole ring fused with benzene and more complex benzotriazole derivatives usually contain some additional fused rings. The benzotriazole nucleus is pharmaceutically important and emerging heterocycle with broad spectrum of activities including antibacterial,[10–12] antifungal,[13,14] antitubercular[15] and anticancer.[16] We have decided to explore some of these facets in our previous work.[17] In the previous study !b-lactam derivatives of 1,2,3-benzotriazole have been synthesized and screened for their biological activity. In the recent study we are reporting synthesis and biological activities of 4-oxothiazolidine **4a–j** and their 5-arylidene derivatives of 1,2,3-benzotriazole **5a–j.** Compounds **1**, **2** and **3a–j** have been synthesized using similar method as described in the previous study (Scheme 1).

2. Results and Discussion: Synthesis

The 1,2,3-benzotriazole was used as the starting material for the synthesis of **1**, **2** and **3a–j** using similar method as described in our previous study.[17] The compounds **3a–j** on reaction with equimolar amount of thioglycolic acid in the presence of $ZnCl_2$ gave the cycloaddition reaction and produced **4a–j**. The compound **4a** showed a characteristic absorption of the cyclic carbonyl group at 1672 cm^{-1} in the IR spectrum. The ^{1}H NMR spectrum of **4a** aroused our attention and clearly indicates the presence of the active methylene protons of the thiazolidine ring at δ 3.37 ppm. The ^{13}C NMR spectrum of **4a** also supported



Comp.	Ar = Ar_1	Comp.	Ar = Ar_1
4a, 5a		**4f, 5f**	
4b, 5b		**4g, 5g**	
4c, 5c		**4h, 5h**	
4d, 5d		**4i, 5i**	
4e, 5e		**4j, 5j**	

Scheme 1: Synthesis of compounds **4(a-j)** and **5(a-j).**

the fact that cyclic carbonyl group is present as a signal appeared at δ 168.7 ppm. All these facts are additionally supported by the disappearance of N=CH proton and appearance of N-CH proton at δ 5.15 ppm in the ^{1}H NMR spectrum of **4a**. The compounds **4a**–**j** underwent the Knoevenagel condensation reaction with substituted benzaldehydes in the presence of C_2H_5ONa to afford **5a**–**j**. In the ^{1}H NMR spectrum of **5a**–**j** two methylene protons of

Table 1: Antibacterial, antifungal and antitubercular activities of compounds **5(a-j).**

Comp.	Antibacterial activity			Antifungal activity			Antitubercular activity
	B. subtilis	*E. coli*	*S. aureus*	*A. niger*	*A. flavus*	*C. albicans*	*M. tuberculosis*
5a	12.5	9.25	12.50	20.25	21.25	20.25	12.5
5b	3.75	6.25	3.25	15.75	13.25	15.25	2.50
5c	6.25	3.75	6.25	12.75	12.50	12.75	2.75
5d	3.75	6.25	3.25	12.50	12.25	13.50	2.50
5e	3.25	3.75	3.25	13.25	12.25	13.75	2.75
5f	6.25	3.25	3.25	12.75	13.25	12.75	2.75
5g	4.75	6.25	4.50	16.25	14.50	15.75	6.25
5h	3.25	3.75	3.25	12.50	13.50	12.75	2.50
5i	3.25	3.25	3.75	12.25	12.75	13.5	2.50
5j	3.25	3.75	3.25	12.75	12.50	13.50	2.75

the mic values of standard streptomycin for all bacterial strain and griseofulvin for all fungal strain were in the range of 2.50–3.25 and 6.25–12.50 μg/ml respectively. Isoniazid and rifampicin were used as standards, mic values in the range of 1.25–2.50 μg/ml for m. *tuberculosis.*

4a–**j** have disappeared and a new signal for C=CH appeared in the range of δ 6.52–6.77 ppm in the ^{1}H NMR spectra and two new signals for C=*C*H and *C*=CH appeared in the range of δ 136.7–141.2 and δ 141.9–144.9 ppm, respectively, in the ^{13}C NMR spectra of **5a**–**j**. All these facts clearly confirmed the synthesis of all final products.

3. Results and Discussion: Biological Study

The results of the all described activities (antibacterial, antifungal, antitubercular and antiinflammatory) are summarized in Tables 1 and 2. The results of the antimicrobial screening data revealed that **5a**–**j** showed considerable and varied activity against the selected microorganisms. A new series of *N*-[3-(1*H*-1,2,3-benzotriazol-1-yl)-propyl]-2-(substituted phenyl)-4-oxo-5-(substituted benzylidene)-1,3-thiazolidine-carboxamide **5a**–**j** were synthesized and screened for their antimicrobial, antitubercular and anti-inflammatory activities. Data (as shown in Table 1 and 2) revealed that all the synthesized compounds **5a**–**j** have a structure activity relationship (SAR) because activities of compounds varies with substitution. Nitro group containing compounds (**5h**, **5i** and **5j**) showed higher activity than those containing chloro (**5c**, **5d**) and bromo groups (**5e**, **5f**). On the other hand, chloro and bromo derivatives have higher activity than other tested compounds. On the basis of SAR, it might be concluded that the activity of compounds depends on electron withdrawing nature of the substitutents.

Table 2: Antiinflammatory activity of compounds **5(a-j)**.

Compound Code	Before carageenan administration (mean ± SEM)	Total increase in paw volume after 5 hours (mean ± SEM)	Percent inhibition
5a	0.60 ± 0.02	0.16 ± 0.02	50.00
5b	0.64 ± 0.02	0.14 ± 0.02	56.25
5c	0.66 ± 0.02	0.13 ± 0.01	59.38
5d	0.68 ± 0.02	0.13 ± 0.02	59.38
5e	0.66 ± 0.03	0.14 ± 0.02	56.25
5f	0.65 ± 0.02	0.12 ± 0.01	62.50
5g	0.67 ± 0.02	0.13 ± 0.01	59.38
5h	0.64 ± 0.03	0.12 ± 0.01	62.50
5i	0.65 ± 0.02	0.10 ± 0.03	68.75
5j	0.67 ± 0.03	0.11 ± 0.02	65.63
Control	0.66 ± 0.02	0.32 ± 0.01	–
Standard; phenylbutazone	0.68 ± 0.03	0.08 ± 0.02	75.00

The investigation of antimicrobial (antibacterial, antifungal and antitubercular) data revealed that the compounds **5c**–**f**,**h**–**j** displayed high activity in the series, the compounds **5b** and **5g** showed moderate activity and the rest of the compounds showed lesser activity against all the strains compared with standard drugs. In the anti-inflammatory activity compounds **5c**–**f**,**h**–**j** showed high activity while the rest of the compounds displayed moderate to low activity.

4. Conclusion

The research study reports the successful synthesis of a new series of **5a**–**j**. The compounds **5a**–**j** containing thiazolidine moiety possess moderate to good antibacterial, antifungal, antitubercular and anti-inflammatory activities.

5. Experimental: Synthesis

Melting points were determined in open capillaries and are uncorrected. Progress of reactions was monitored by silica gel-G coated TLC plates in MeOH:$CHCl_3$ sys-

tem (1:9). Spots were visualized by exposing dry plates in iodine vapours. IR spectra were recorded as KBr discs on a Shimadzu 8201 PC, FTIR spectrophotometer (ν_{max} in cm^{-1}) and ^1H and ^{13}C NMR spectra were measured on a Bruker DRX-300 spectrometer in $CDCl_3$ at 300 and 75 MHz, respectively, using TMS as the internal standard. All chemical shifts are reported on scale. The FAB-MS spectra were recorded on a Jeol SX–102 mass spectrometer. Elemental analyses were performed on a Carlo Erba–1108 analyzer. The analytical data of all the compounds were highly satisfactory. For column chromatographic purification of the products Merck silica Gel 60 (230–400 mesh) was used. Antiinflammatory (*in vivo*) study has been approved by institutional ethical committee, Dr. H. S. Gour University, Sagar, India. The reagent grade chemicals were purchased from the commercial sources and further purified before use.

Synthesis of *N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl] -2-(phenyl)-4-oxo-1,3-thiazolidine-carboxamide (4a)

Mixture of **3a** (0.016 mol) and thioglycolic acid (0.016 mol) in methanol (50 mL) in the presence of $ZnCl_2$ was first stirred on a magnetic stirrer for about 2.30 h at room temperature followed by reflux on a steam bath for about 6.00 h. The completion of the reaction was monitored by silica gel-G coated TLC plates. The product was filtered, cooled and purified with column chromatography (silica gel packed column) using MeOH:$CHCl_3$ (3:7 v/v) system as eluant (70 mL). The purified product was dried under vacuo and recrystallized from ethanol at room temperature to furnish compound **4a** (Figure 1).

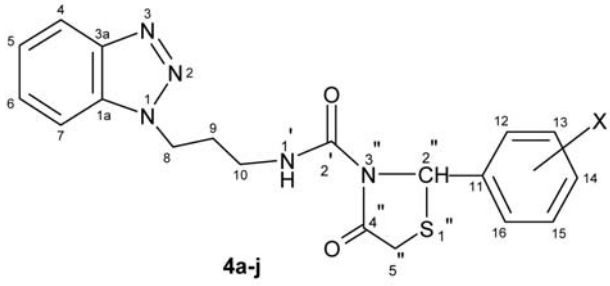


Figure 1: Structure of compounds **4a**–**j**.

Compounds **4b**–**j** have been synthesized by using similar method as above.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(phenyl)-4-oxo-1,3-thiazolidine-carboxamide (4a):**

Yield: 62%; m.p. 81–82 °C; IR (cm^{-1}): 668 (C-S-C), 1332 (C-N), 1478 (C=C), 1571 (N=N), 1672 (CO), 1740 (CO cyclic), 1438, 2843, 2903 (CH_2), 2940 (S-CH_2), 3032 (CH-Ar), 3373 (NH); ^1H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.18–2.22 (m, 2H, H-9), 3.37 (s, 2H, H-5''), 3.40–3.44 (m, 2H, H-10), 4.10 (t, 2H, *J* = 7.35 Hz, H-8), 5.15 (s, 1H, H-2''), 5.80 (s, 1H, H-1'), 6.72–8.09 (m, 9H, Ar-H), ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 33.5 (C-5''), 36.6 (C-9), 45.1 (C-10), 47.3 (C-8), 61.7 (C-2''), 110.3 (C-4), 118.9 (C-7), 125.7 (C-5), 126.4 (C-12 and C-16), 128.4 (C-6), 129.8 (C-14), 130.1 (C-13 and C-15), 132.6 (C-3a), 136.4 (C-11), 145.9 (C-7a), 161.1 (C-2'), 168.7 (C-4''); FAB-MS (*m/z*): 381 [M^+]; Anal. Calcd. for $C_{19}H_{19}N_5O_2S$: C, 59.82; H, 5.02; N, 18.35%. Found: C, 59.74; H, 4.97; N, 18.29%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(4-chlorophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4b):**

Yield: 64%; m.p. 95–96 °C; IR (cm^{-1}): 672 (C-S-C), 761 (C-Cl), 1340 (C-N), 1485 (C=C), 1596 (N=N), 1670 (CO), 1745 (CO cyclic), 1442, 2836, 2933 (CH_2), 2941 (S-CH_2), 3024 (CH-Ar), 3378 (NH) (Figure 2); ^1H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.15–2.21 (m, 2H, H-9), 3.40–3.45 (m, 2H, H-10), 3.46 (s, 2H, H-5''), 4.22 (t, 2H, *J* = 7.40 Hz, H-8), 5.46 (s, 1H, H-2''), 5.61 (s, 1H, H-1'), 7.29–7.82 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 35.2 (C-5''), 34.4 (C-9), 40.2 (C-10), 45.3 (C-8), 62.3 (C-2''), 116.2 (C-4), 120.9 (C-7), 123.7 (C-5), 127.7 (C-12 and C-16), 128.6 (C-6), 129.4 (C-13 and C-15), 132.8 (C-3a), 135.5 (C-14), 136.7 (C-11), 146.9 (C-7a), 164.1 (C-2'), 174.5 (C-4''); FAB-MS (*m/z*): 415 [M^+]; Anal. Calcd. for $C_{19}H_{18}ClN_5O_2S$: C, 54.87; H, 4.36; N, 16.83%. Found: C, 54.82; H, 4.31; N, 16.78%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(3-chlorophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4c):**

Yield: 65%; m.p. 93–95 °C; IR (cm^{-1}): 662 (C-S-C), 745 (C-Cl), 1343 (C-N), 1486 (C=C), 1580 (N=N), 1681 (CO), 1747 (CO cyclic), 1445, 2853, 2911 (CH_2), 2944 (S-CH_2), 3043 (CH-Ar), 3382 (NH); ^1H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.29-2.33 (m, 2H, H-9), 3.35–3.39 (m, 2H, H-10), 3.45 (s, 2H, H-5''), 4.33 (t, 2H, *J* = 7.45 Hz, H-8), 5.41 (s, 1H, H-2''), 5.74 (s, 1H, H-1'), 7.31–7.85 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 34.9 (C-5''), 35.2 (C-9), 40.5 (C-10), 45.6 (C-8), 64.3 (C-2''), 114.2 (C-4), 118.4 (C-7), 124.3 (C-5), 126.7 (C-12), 128.3 (C-16), 129.1 (C-6), 129.9 (C-14), 131.4 (C-15), 134.4 (C-3a), 135.3 (C-13), 138.1 (C-11), 147.9 (C-7a), 164.3 (C-2'), 171.2 (C-4''); FAB-MS (*m/z*): 415 [M^+]; Anal. Calcd. for $C_{19}H_{18}ClN_5O_2S$: C, 54.87; H, 4.36; N, 16.83%. Found: C, 54.80; H, 4.30; N, 16.75%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(2-chlorophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4d):**

Yield: 62 %; m.p. 90–91 °C; IR (cm^{-1}): 656 (C-S-C), 738 (C-Cl), 1347 (C-N), 1490 (C=C), 1582 (N=N), 1683 (CO), 1746 (CO cyclic), 1447, 2851, 2909 (CH_2), 2947 (S-CH_2), 3041 (CH-Ar), 3380 (NH); ^1H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.20–2.26 (m, 2H, H-9), 3.44–3.49 (m, 2H, H-10), 3.41 (s, 2H, H-5''), 4.25 (t, 2H, *J* = 7.40 Hz, H-8), 5.42 (s, 1H, H-2''), 5.65 (s, 1H, H-1'), 7.36–7.86 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 35.1 (C-5''), 36.8 (C-9), 39.7 (C-10), 47.4 (C-8), 64.2 (C-2''), 114.5 (C-4), 119.9 (C-7), 124.7

(C-5), 127.6 (C-15), 128.9 (C-6), 129.4 (C-13), 130.4 (C-14), 132.2 (C-16), 133.3 (C-3a), 135.1 (C-12), 137.9 (C-11), 147.4 (C-7a), 163.6 (C-2'), 173.7 (C-4'') FAB-MS (*m/z*): 415 [M$^+$]; Anal. Calcd. for $C_{19}H_{18}ClN_5O_2S$: C, 54.87; H, 4.36; N, 16.83%. Found: C, 54.83; H, 4.33; N, 16.73%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(4-bromophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4e):**

Yield: 66 %; m.p. 92–93 °C; IR (cm^{-1}): 655 (C-S-C), 741 (C-Cl), 1338 (C-N), 1488 (C=C), 1577 (N=N), 1687 (CO), 1750 (CO cyclic), 1449, 2854, 2912 (CH_2), 2946 (S-CH_2), 3045 (CH-Ar), 3379 (NH); ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.21–2.25 (m, 2H, H-9), 3.47–3.53 (m, 2H, H-10), 3.40 (s, 2H, H-5''), 4.32 (t, 2H, *J* = 7.45 Hz, H-8), 5.47 (s, 1H, H-2''), 5.67 (s, 1H, H-1'), 7.38–7.83 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 35 (C-5''), 34.8 (C-9), 41.4 (C-10), 48.2 (C-8), 64.3 (C-2''), 112.4 (C-4), 119.4 (C-7), 123.9 (C-14), 124.5 (C-5), 128.6 (C-6), 130.8 (C-12 and C-16), 131.4 (C-13 and C-15), 132.6 (C-3a), 136.5 (C-11), 147.9 (C-7a), 164.2 (C-2'), 172.3 (C-4''); FAB-MS (*m/z*): 460 [M$^+$]; Anal. Calcd. for $C_{19}H_{18}BrN_5O_2S$: C, 49.57; H, 3.94; N, 15.21%. Found: C, 49.51; H, 3.88; N, 15.19%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(3-bromophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4f):**

Yield: 64 %; m.p. 81–82 °C; IR (cm^{-1}): 679 (C-S-C), 749 (C-Cl), 1350 (C-N), 1484 (C=C), 1577 (N=N), 1684 (CO), 1745 (CO cyclic), 1452, 2848, 2909 (CH_2), 2948 (S-CH_2), 3040 (CH-Ar), 3383 (NH); ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.24–2.29 (m, 2H, H-9), 3.33–3.38 (m, 2H, H-10), 3.44 (s, 2H, H-5''), 4.31 (t, 2H, *J* = 7.55 Hz, H-8), 5.43 (s, 1H, H-2''), 5.76 (s, 1H, H-1'), 7.25–7.79 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 33.8 (C-5''), 37.1 (C-9), 41.9 (C-10), 46.5 (C-8), 60.9 (C-2''), 109.2 (C-4), 118.9 (C-7), 123.7 (C-13), 124.7 (C-5), 125.6 (C-16), 128.4 (C-6), 129.8 (C-12), 132.5 (C-15), 133.4 (C-14), 134.5 (C-3a), 140.3 (C-11), 145.6 (C-7a), 163.7 (C-2'), 172.6 (C-4''); FAB-MS (*m/z*): 460 [M$^+$]; Anal. Calcd. for $C_{19}H_{18}BrN_5O_2S$: C, 49.57; H, 3.94; N, 15.21%. Found: C, 49.54; H, 3.87; N, 15.14%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(2-bromophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4g):**

Yield: 67%; m.p. 85–87 °C, IR (cm^{-1}): 659 (C-S-C), 1341 (C-N), 1481 (C=C), 1580 (N=N), 1682 (CO), 1748 (CO cyclic), 1446, 2853, 2916 (CH_2), 2945 (S-CH_2), 3042 (CH-Ar), 3385 (NH); ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.17–2.21 (m, 2H, H-9), 3.36–3.42 (m, 2H, H-10), 3.45 (s, 2H, H-5''), 4.38 (t, 2H, *J* = 7.50 Hz, H-8), 5.19 (s, 1H, H-2''), 5.78 (s, 1H, H-1'), 7.26–7.77 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 34.6 (C-5''), 37.4 (C-9), 42.2 (C-10), 46.8 (C-8), 59.9 (C-2''), 111.1 (C-4), 119.5 (C-7), 120.3 (C-12), 125.7 (C-5), 127.2 (C-15), 128.4 (C-6), 130.1 (C-16), 131.5 (C-14), 132.2 (C-3a), 133.2 (C-13), 142.6 (C-11), 147.9 (C-7a), 163.1 (C-2'), 172.5 (C-4''); FAB-MS (*m/z*): 460 [M$^+$]; Anal. Calcd. for $C_{19}H_{18}BrN_5O_2S$: C, 49.57; H, 3.94; N, 15.21%. Found: C, 49.50; H, 3.82; N, 15.12%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(4-nitrophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4h):**

Yield: 61%; m.p. 90–91 °C; IR (cm^{-1}): 655 (C-S-C), 865 (C-NO), 1322 (C-N), 1478 (N=O), 1486 (C=C), 1579 (N=N), 1682 (CO), 1752 (CO cyclic), 1450, 2853, 2913 (CH_2), 2944 (S-CH_2), 3044 (CH-Ar), 3381 (NH); ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.30–2.34 (m, 2H, H-9), 3.31–3.36 (m, 2H, H-10), 3.49 (s, 2H, H-5''), 4.37 (t, 2H, *J* = 7.50 Hz, H-8), 5.16 (s, 1H, H-2''), 5.82 (s, 1H, H-1'), 7.26–7.84 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 36.7 (C-5''), 37.9 (C-9), 42.6 (C-10), 47.7 (C-8), 62.1 (C-2''), 112.2 (C-4), 118.5 (C-7), 122.6 (C-13 and C-15), 124.8 (C-5), 127.9 (C-12 and C-16), 128.3 (C-6), 132.4 (C-3a), 139.8 (C-11), 145.9 (C-7a), 147.9 (C-14), 163.7 (C-2'), 173.6 (C-4''). FAB-MS (*m/z*): 426 [M$^+$]; Anal. Calcd. for $C_{19}H_{18}N_6O_4S$: C, 53.52; H, 4.25; N, 19.70%. Found: C, 53.47; H, 4.22; N, 19.65%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(3-nitrophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4i):**

Yield: 65%; m.p. 87–89 °C; IR (cm^{-1}): 660 (C-S-C), 867 (C-NO), 1328 (C-N), 1483 (C=C), 1502 (N=O), 1581 (N=N), 1679 (CO), 1754 (CO cyclic), 1448, 2850, 2915 (CH_2), 2947 (S-CH_2), 3048 (CH-Ar), 3384 (NH); ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.25–2.31 (m, 2H, H-9), 3.33–3.38 (m, 2H, H-10), 3.47 (s, 2H, H-5''), 4.34 (t, 2H, *J* = 7.45 Hz, H-8), 5.21 (s, 1H, H-2''), 5.72 (s, 1H, H-1'), 7.29–7.81 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 35.4 (C-5''), 35.7 (C-9), 43.3 (C-10), 48.8 (C-8), 61.2 (C-2''), 113.3 (C-4), 118.9 (C-7), 122.7 (C-12), 124.8 (C-14), 125.9 (C-5), 128.8 (C-6), 129.4 (C-15), 132.6 (C-3a), 132.9 (C-16), 139.7 (C-11), 146.9 (C-7a), 147.9 (C-13), 163.1 (C-2'), 175.6 (C-4''); FAB-MS (*m/z*): 426 [M$^+$]; Anal. Calcd. for $C_{19}H_{18}N_6O_4S$: C, 53.52; H, 4.25; N, 19.70%. Found: C, 53.45; H, 4.20; N, 19.60%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(2-nitrophenyl)-4-oxo-1,3-thiazolidine-carboxamide (4j):**

Yield: 66 %; m.p. 86–88 °C; IR (cm^{-1}): 657 (C-S-C), 872 (C-NO), 1324 (C-N), 1498 (N=O), 1489 (C=C), 1578 (N=N), 1683 (CO), 1751 (CO cyclic), 1449, 2848, 2910 (CH_2), 2949 (S-CH_2), 3043 (CH-Ar), 3382 (NH); ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.25–2.29 (m, 2H, H-9), 3.40–3.45 (m, 2H, H-10), 3.47 (s, 2H, H-5''), 4.28 (t, 2H, *J* = 7.55 Hz, H-8), 5.22 (s, 1H, H-2''), 5.73 (s, 1H, H-1'), 7.34–7.92 (m, 8H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 37.1 (C-5''), 36.3 (C-9), 43.7 (C-10), 49.4 (C-8), 64 (C-2''), 112.4 (C-4), 117.4 (C-7), 122.5 (C-13), 123.8 (C-5), 127.6 (C-16), 128.6 (C-6),

130.8 (C-14), 132.9 (C-3a), 133.5 (C-11), 135.3 (C-15), 145.7 (C-7a), 146.5 (C-12), 161.1 (C-2'), 174.5 (C-4''); FAB-MS (*m/z*): 426 [M^+]; Anal. Calcd. for $C_{19}H_{18}N_6O_4S$: C, 53.52; H, 4.25; N, 19.70%. Found: C, 53.42; H, 4.19; N, 19.62%.

Synthesis of *N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl] -2-(phenyl)-4-oxo-5-(benzylidene)-1,3-thiazolidine-carboxamide (5a)

Mixture of **4a** (0.010 mol) and benzaldehyde (0.010 mol) in methanol (50 mL) in the presence of EtONa was first stirred on a magnetic stirrer for about 2.00 h at room temperature followed by reflux on a steam bath for about 4.00 h. The completion of the reaction was monitored by silica gel-G coated TLC plates. The product was filtered, cooled and purified with column chromatography (silica gel packed column) using MeOH: $CHCl_3$ (3:7 v/v) system as eluant (90 mL). The purified product was dried under vacuo and recrystallized from ethanol at room temperature to furnish compound **5a** (Figure 1).

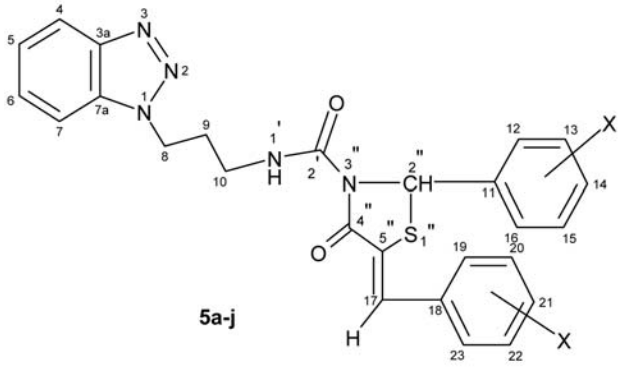


Figure 1: Structure of compounds **5a**–**j**.

Compounds **5 (b-j)** have been synthesized by using similar method as above.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(phenyl)-4-oxo-5-(benzylidene)-1,3-thiazolidine-carboxamide (5a):**

Yield: 57%; m.p. 79–81 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.24–2.29 (m, 2H, H-9), 3.48–3.53 (m, 2H, H-10), 4.37 (t, 2H, *J* = 7.50 Hz, H-8), 5.72 (s, 1H, H-1'), 5.27 (s, 1H, H-2''), 6.52 (H-17), 6.86–7.72 (m, 14H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 38.2 (C-9), 45.2 (C-10), 51.1 (C-8), 63.7 (C-2''), 110.3 (C-4), 118.9 (C-7), 125.7 (C-5), 126.4 (C-12 and C-16), 126.4 (C-19 and C-23), 128.4 (C-6), 129.8 (C-16), 129.8 (C-14), 130.1 (C-13 and C-15), 131.7 (C-20 and C-22), 132.6 (C-3a), 136.4 (C-11), 138.7 (C-18), 136.7 (C-17), 143.2 (C-5''), 145.9 (C-7a), 161.1 (C-2'), 168.7 (C-4''); IR (cm^{-1}): 1560 (C=CH), 1336 (C-N), 1477 (C=C), 1544 (N=N), 1674 (CO), 1737 (CO cyclic), 1445, 2842, 2903 (CH_2), 3034 (CH-Ar), 3375 (NH), 2850 (C=CH), 3339 (NH); FAB-MS (*m/z*): 469 [M^+]; Anal. Calcd. for $C_{26}H_{23}N_5O_2S$: C, 66.50; H, 4.93; N, 14.91%. Found: C, 66.46; H, 4.89; N, 14.87%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(4-chlorophenyl)-4-oxo-5-(4-chlorobenzylidene)-1,3-thiazolidine-carboxamide (5b):**

Yield: 60%; m.p. 89–91 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.41–2.46 (m, 2H, H-9), 3.59-3.63 (m, 2H, H-10), 4.50 (t, 2H, *J* = 7.45 Hz, H-8), 5.79 (s, 1H, H-1'), 5.21 (s, 1H, H-2''), 6.71 (s, 1H, H-17), 6.86–7.72 (m, 12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 39.7 (C-9), 42.9 (C-10), 50.4 (C-8), 62.2 (C-2''), 116.2 (C-4), 120.9 (C-7), 123.7 (C-5), 127.7 (C-12 and C-16), 128.0 (C-19 and C-23), 128.6 (C-6), 129.4 (C-13 and C-15), 130.3 (C-20 and C-22), 131.4 (C-16), 131.9 (C-14), 132.8 (C-3a), 136.7 (C-18), 136.7 (C-11), 137.2 (C-17), 143.5 (C-5''), 146.9 (C-7a), 164.1 (C-2'), 174.5 (C-4''); IR (cm^{-1}): 732 (C-Cl), 1470 (C=CH), 2868 (C=CH), 1344 (C-NH), 1485 (C=C), 1546 (N=N), 1680 (CO), 1742 (CO cyclic), 1452, 2846, 2908 (CH_2), 3039 (CH-Ar), 3381 (NH); FAB-MS (*m/z*): 538 [M^+]; Anal. Calcd. for $C_{26}H_{21}Cl_2N_5O_2S$: C, 57.99; H, 3.93; N, 13.00%. Found: C, 57.94; H, 3.87; N, 12.94%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(3-chlorophenyl)-4-oxo-5-(3-chlorobenzylidene)-1,3-thiazolidine-carboxamide (5c):**

Yield: 62%; m.p. 86–87 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.45–2.49 (m, 2H, H-9), 3.60–3.65 (m, 2H, H-10), 4.47 (t, 2H, *J* = 7.50 Hz, H-8), 5.95 (s, 1H, H-1'), 5.23 (s, 1H, H-2''), 6.68 (s, 1H, H-17), 6.86–7.72 (m, 12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 38.6 (C-9), 43.6 (C-10), 47.3 (C-8), 61.9 (C-2''), 114.2 (C-4), 118.4 (C-7), 124.3 (C-5), 126.7 (C-12), 127.5 (C-19), 128.3 (C-16), 128.9 (C-23), 129.1 (C-6), 129.9 (C-14), 130.5 (C-21), 131.4 (C-13), 132.9 (C-22), 134.4 (C-3a), 135.3 (C-13), 136.6 (C-20), 138.1 (C-11), 139.7 (C-18), 140.1 (C-17), 143.2 (C-5''), 147.9 (C-7a), 164.3 (C-2'), 171.2 (C-4''); IR (cm^{-1}): 738 (C-Cl), 1335 (N-C), 1474 (C=CH), 2862 (C=CH) 1489 (C=C), 1552 (N=N), 1685 (CO), 1747 (CO cyclic), 1452, 2854, 2914 (CH_2), 3047 (CH-Ar), 3382 (NH); FAB-MS (*m/z*): 538 [M^+]; Anal. Calcd. for $C_{26}H_{21}Cl_2N_5O_2S$: C, 57.99; H, 3.93; N, 13.00%. Found: C, 57.92; H, 3.76; N, 12.91%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(2-chlorophenyl)-4-oxo-5-(2-chlorobenzylidene)-1,3-thiazolidine-carboxamide (5d):**

Yield: 61; m.p. 82–83 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.37–2.43 (m, 2H, H-9), 3.53–3.59 (m, 2H, H-10), 4.44 (t, 2H, *J* = 7.55 Hz, H-8), 5.85 (s, 1H, H-1'), 5.29 (s, 1H, H-2''), 6.72 (s, 1H, H-17), 6.86–7.72 (m, 12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 36.8 (C-9), 43.8 (C-10), 47.6 (C-8), 63.4 (C-2''), 114.5 (C-4), 119.9 (C-7), 124.7 (C-5), 127.6 (C-13), 128.2 (C-22), 128.9 (C-6), 129.4 (C-13), 130.1 (C-20), 130.4 (C-14),

131.6 (C-21), 132.2 (C-16), 132.2 (C-23), 133.3 (C-3a), 135.1 (C-12), 135.1 (C-19), 137.9 (C-11), 137.9 (C-8), 138.3 (C-17), 143.1 (C-5''), 147.4 (C-7a), 163.6 (C-2'), 173.7 (C-4''); IR (cm^{-1}): 742 (C-Cl), 1576 (C=CH), 2866 (C=CH) 1338 (C-NH), 1492 (C=C), 1549 (N=N), 1684 (CO), 1752 (CO cyclic), 1454, 2857, 2917 (CH_2), 3046 (CH-Ar), 3388 (NH); FAB-MS (*m/z*): 538 [M^+]; Anal. Calcd. for $C_{26}H_{21}Cl_2N_5O_2S$: C, 57.99; H, 3.93; N, 13.00%. Found: C, 57.90; H, 3.85; N, 12.90%.

_N_-[3-(1_H_-1,2,3-Benzotriazol-1-yl)-propyl]-2-(4-bromophenyl)-4-oxo-5-(4-bromobenzylidene)-1,3-thiazolidine-carboxamide (5e):

Yield: 62%; m.p. 78–79 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.38–2.42 (m, 2H, H-9), 3.52–3.57 (m, 2H, H-10), 4.46 (t, 2H, *J* = 7.45 Hz, H-8), 5.92 (s, 1H, H-1'), 5.11 (s, 1H, H-2''), 6.77 (s, 1H, H-17), 6.86–7.72 (m, 12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 39.4 (C-9), 43.8 (C-10), 47.6 (C-8), 63.4 (C-2''), 112.4 (C-4), 119.4 (C-7), 123.9 (C-14), 123.9 (C-21), 124.5 (C-5), 128.6 (C-6), 130.8 (C-12 and C-16), 131.2 (C-19 and C-23), 131.4 (C-13 and C-15), 131.8 (C-20 and C-22), 132.6 (C-3a), 136.5 (C-11), 137.7 (C-18), 138.8 (C-17), 141.9 (C-5''), 147.9 (C-7a), 164.2 (C-2'), 172.3 (C-4''); IR (cm^{-1}): 561 (C-Br), 1472 (C=CH), 2856 (C=CH) 1346 (C-N), 1490 (C=C), 1553 (N=N), 1681 (CO), 1750 (CO cyclic), 1455, 2852, 2915 (CH_2), 3042 (CH-Ar), 3385 (NH); FAB-MS (*m/z*): 627 [M^+]; Anal. Calcd. for $C_{26}H_{21}Br_2N_5O_2S_2$: C, 49.77; H, 3.37; N, 11.16%. Found: C, 49.73; H, 3.33; N, 11.12%.

_N_-[3-(1_H_-1,2,3-Benzotriazol-1-yl)-propyl]-2-(3-bromophenyl)-4-oxo-5-(3-bromobenzylidene)-1,3-thiazolidine-carboxamide (5f):

Yield: 64%; m.p. 81–82 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.40–2.44 (m, 2H, H-9), 3.60–3.67 (m, 2H, H-10), 4.51 (t, 2H, *J* = 7.40 Hz, H-8), 5.89 (s, 1H, H-1'), 5.19 (s, 1H, H-2''), 6.68 (s, 1H, H-17), 6.86–7.72 (m, 12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 37.5 (C-9), 44.3 (C-10), 49.3 (C-8), 64.6 (C-2''), 109.2 (C-4), 118.9 (C-7), 123.7 (C-13), 124.6 (C-20), 124.7 (C-5), 125.6 (C-16), 125.6 (C-23), 128.4 (C-6), 129.8 (C-12), 130.8 (C-19), 132.5 (C-13), 133.4 (C-22), 133.9 (C-14), 134.3 (C-21), 134.5 (C-3a), 140.3 (C-11), 140.8 (C-17), 142.5 (C-5''), 142.7 (C-18), 145.6 (C-7a), 163.7 (C-2'), 172.6 (C-4''); IR (cm^{-1}): 568 (C-Br) 2852 (C=CH), 1475 (C=CH), 1347 (C-NH), 1484 (C=C), 1550 (N=N), 1679 (CO), 1745 (CO cyclic), 1450, 2848, 2909 (CH_2), 3040 (CH-Ar), 3384 (NH); FAB-MS (*m/z*): 627 [M^+]; Anal. Calcd. for $C_{26}H_{21}Br_2N_5O_2S$: C, 49.77; H, 3.37; N, 11.16%. Found: C, 49.72; H, 3.34; N, 11.14%.

_N_-[3-(1_H_-1,2,3-Benzotriazol-1-yl)-propyl]-2-(2-bromophenyl)-4-oxo-5-(2-bromobenzylidene)-1,3-thiazolidine-carboxamide (5g):

Yield: 63%; m.p. 75–76 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.40–2.45 (m, 2H, H-9), 3.55–3.61 (m, 2H, H-10), 4.49 (t, 2H, *J* = 7.50 Hz, H-8), 5.91 (s, 1H, H-1'), 5.17 (s, 1H, H-2''), 6.59 (s, 1H, H-17), 6.86–7.72 (m, 12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 40.3 (C-9), 45.9 (C-10), 48.4 (C-8), 62.6 (C-2''), 111.1 (C-4), 119.5 (C-7), 120.3 (C-12), 122.6 (C-19), 125.7 (C-5), 126.5 (C-15), 127.2 (C-22), 128.4 (C-6), 129.3 (C-16), 130.1 (C-23), 131.3 (C-14), 132.8 (C-21), 133.2 (C-3a), 134.5 (C-13), 135.7 (C-20), 138.7 (C-17), 142.2 (C-5''), 142.6 (C-11), 144.2 (C-22), 147.9 (C-7a), 163.1 (C-2'), 172.5 (C-4''); IR (cm^{-1}): 564 (C-Br), 1479 (C=CH), 2856 (C=CH), 1352 (C-NH), 1494 (C=C), 1551 (N=N), 1686 (CO), 1749 (CO cyclic), 1456, 2857, 2915 (CH_2), 3045 (CH-Ar), 3386 (NH); FAB-MS (*m/z*): 627 [M^+]; Anal. Calcd. for $C_{26}H_{21}Br_2N_5O_2S$: C, 49.77; H, 3.37; N, 11.16%. Found: C, 49.70; H, 3.30; N, 11.10%.

_N_-[3-(1_H_-1,2,3-Benzotriazol-1-yl)-propyl]-2-(4-nitrophenyl)-4-oxo-5-(4-nitrobenzylidene)-1,3-thiazolidine-carboxamide (5h):

Yield: 60; m.p. 73–74 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.34–2.39 (m, 2H, H-9), 3.52–3.58 (m, 2H, H-10), 4.50 (t, 2H, *J* = 7.55 Hz, H-8), 5.13 (s, 1H, H-2''), 5.87 (s, 1H, H-1'), 6.61 (s, 1H, H-17), 6.81–7.71 (m,12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 37.7 (C-9), 44.8 (C-10), 48.9 (C-8), 64.2 (C-2''), 112.2 (C-4), 118.5 (C-7), 122.6 (C-13 and C-15), 123.2 (C-20 and C-22), 124.8 (C-5), 126.9 (C-12 and C-16), 127.4 (C-19 and C-23), 128.3 (C-6), 132.4 (C-3a), 139.8 (C-11), 138.3 (C-17), 140.3 (C-18), 142.3 (C-5''), 145.9 (C-7a), 147.9 (C-14), 148.5 (C-21), 163.7 (C-2'), 173.6 (C-4''); IR (cm^{-1}): 865 (C-NO), 1495 (N=O), 1578 (C=CH), 2857 (C=CH) 1345 (C-N), 1488 (C=C), 1547 (N=N), 1683 (CO), 1744 (CO cyclic), 1451, 2850, 2912 (CH_2), 3045 (CH-Ar), 3387 (NH); FAB-MS (*m/z*): 559 [M^+]; Anal. Calcd. for $C_{26}H_{21}N_7O_6S$: C, 5.80; H, 3.78; N, 17.52%. Found: C, 55.77; H, 3.72; N, 17.48%.

_N_-[3-(1_H_-1,2,3-Benzotriazol-1-yl)-propyl]-2-(3-nitrophenyl)-4-oxo-5-(3-nitrobenzylidene)-1,3-thiazolidine-carboxamide (5i):

Yield: 64%; m.p. 81–82 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.43–2.48 (m, 2H, H-9), 3.50–3.54 (m, 2H, H-10), 4.48 (t, 2H, *J* = 7.50 Hz, H-8), 5.15 (s, 1H, H-2''), 5.90 (s, 1H, H-1'), 6.69 (s, 1H, H-17), 6.79–7.68 (m, 12H, Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 40.2 (C-9), 45.2 (C-10), 49.7 (C-8), 65.8 (C-2''), 113.3 (C-4), 118.9 (C-7), 121.8 (C-12), 122.7 (C-19), 123.6 (C-14), 124.8 (C-21), 125.9 (C-5), 128.8 (C-6), 129.4 (C-15), 130.4 (C-22), 132.6 (C-3a), 132.9 (C-16), 134.2 (C-23), 139.7 (C-11), 140.3 (C-17), 141.4 (C-18), 143.1 (C-5''), 146.9 (C-7a), 147.9 (C-13), 148.2 (C-20), 163.1 (C-2'), 175.6 (C-4''); IR (cm^{-1}): 841 (C-NO), 1480 (C=CH), 1497 (N=O), 2864 (C=CH), 1350 (C-N), 1493 (C=C), 1548 (N=N), 1682 (CO), 1748 (CO cyclic), 1453, 2853, 2910 (CH_2), 3044 (CH-Ar), 3384 (NH); FAB-MS (*m/z*):

559 [M^+]; Anal. Calcd. for $C_{26}H_{21}N_7O_6S$: C, 55.80; H, 3.78; N, 17.52%. Found: C, 55.75; H, 3.73; N, 17.46%.

***N*-[3-(1*H*-1,2,3-Benzotriazol-1-yl)-propyl]-2-(2-nitrophenyl)-4-oxo-5-(2-nitrobenzylidene)-1,3-thiazolidinecarboxamide (5j):**

Yield: 62%; m.p. 84–85 °C; ^{1}H NMR (300 MHz, $CDCl_3$, TMS) δ: 2.34–2.40 (m, 2H, H-9), 3.60–3.65 (m, 2H, H-10), 4.53 (t, 2H, *J* = 7.45 Hz, H-8), 5.14 (s, 1H, H-2''), 5.83 (s, 1H, H-1'), 6.62 (s, 1H, H-17), 6.89–7.75 (m, 12H ,Ar-H); ^{13}C NMR (75 MHz, $CDCl_3$, TMS) δ: 38.6 (C-9), 45.5 (C-10), 50.9 (C-8), 63.8 (C-2''), 112.4 (C-4), 117.4 (C-7), 121.2 (C-13), 122.5 (C-20), 123.8 (C-5), 126.8 (C-16), 127.6 (C-23), 128.6 (C-6), 130.8 (C-14), 131.3 (C-21), 132.9 (C-3a), 133.5 (C-11), 134.8 (C-18), 135.3 (C-15), 136.7 (C-22), 141.2 (C-17), 144.9 (C-5''), 145.7 (C-7a), 146.5 (C-12), 147.9 (C-19), 161.1 (C-2'), 174.5 (C-4''); IR (cm^{-1}): 852 (C-NO), 1478 (N=O), 1489 (C=CH), 2870 (C=CH), 1355 (C-NH), 1497 (C=C), 1553 (N=N), 1689 (CO), 1751 (CO cyclic), 1457, 2858, 2919 (CH_2), 3047 (CH-Ar), 3387 (NH); FAB-MS (*m/z*): 559 [M^+]; Anal. Calcd. for $C_{26}H_{21}N_7O_6S$: C, 55.80; H, 3.78; N, 17.52%. Found: C, 55.72; H, 3.74; N, 17.45%.

6. Experimental: Biological Study

6. 1. Antibacterial, Antifungal and Antitubercular Activities

Series of newly synthesized compounds were tested against selected microorganisms. The minimal inhibition concentrations (MIC) were determined using the filter paper disc diffusion method and the concentrations are given in μg/mL. All the final synthesized **5a–j** have been screened *in vitro* for their antibacterial activity against *Bacillus subtilis*, *Escherichia coli* and *Staphylococcus aureus* and antifungal activity against *Aspergillus niger*, *Aspergillus flavus* and *Candida albicans*. Standards for antibacterial and antifungal activities streptomycin and griseofulvin, respectively, were used. The antitubercular activity screened against the *Mycobacterium tuberculosis.* For the antitubercular activity isoniazid and rifampicin were used as standard. Standards were screened under similar conditions for comparison. Results are given in Table 1.

6. 2. Anti-inflammatory Activity

Carageenan induced rat paw oedema method was employed for evaluating the antiinflammatory activity of compounds at a dose 50 mg/kg (bw) in albino rats (weighing 80–110 g, each group containing 5 animals) using phenylbutazone as a standard drug for comparison at a dose 30 mg/kg bw. The rate paw oedema was produced by the method of Winter et *al*. The percentage inhibition of inflammation was calculated by applying Newbould formula. *In vivo* study has been approved by the institutional ethical committee, Dr. H. S. Gour University, Sagar. Results of **5a–j** were given in Table 2.

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Povzetek

Razvili smo učinkovito sintezno pot nove serije *N*-[3-(1*H*-1,2,3-benzotriazol-1-il)-propil]-2-(substituiran fenil)-4-okso-5-(substituiran benziliden)-1,3-tiazolidin-karboksamidov; sintetizirali smo spojine **5a**–**j** in jih karakterizirali z IR, ^{1}H NMR, ^{13}C NMR, FAB-MS in kemijsko elementno analizo. Vse končne produkte smo testirali na antimikrobno aktivnost proti nekaterim izbranim bakterijam in glivam ter za antituberkulozno aktivnost proti *Mycobacterium tuberculosis* ter za proti vnetno aktivnost pri albino podganah.