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Design, Synthesis and Biological Assessment of N-Substituted Pronestyl Sulfonamide Analogues

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ABSTRACT

Pronestyl sulfonamide N-(*2-(diethylamino)ethyl-4-(phenylsulfonamido)benzamide*) and their derivatives were synthesized to check antibacterial activity. Procainamide (Pronestyl) was reacted with benzene sulphonyl chloride in the presence of 10% Na_2CO_3 at room temperature to form the product N-(*2-(diethylamino)ethyl-4-(phenylsulfonamido)benzamide*) **(3)**. This synthesized compound was used further for the synthesis of pronestyl sulfonamide derivatives **(5a-f)** by the reaction of alkyl/aralkyl halides with Pronestyl sulfonamide by using LiH and DMF. The antibacterial activity of these compounds were performed usining ciprofloxacin, the reference standard. Among all synthesized compounds the compound **5e** observed as strong inhibitor against all bacteria like, *Bacillus subtilis (*8.28±2.02), *Staphylococcus aureus (*10.29 ±1.62), *Escherichia coli (*12.43±2.12) and *Pseudomonas aeruginosa (*9.43±1.10) while this compound shows moderate inhibition against *Salmonella typhi*. The synthesized molecules Pronestyl sulfonamide derivatives were structurally confirmed by IR, ^{1}H-NMR and EIMS spectral data.

Key Words: Procainamide (Pronestyl), benzene sulphonyl chloride, antibacterial activity.

1. INTRODUCTION

The main sulfonamide was prepared during the 1930s[1], which are the intermediates of amines[2] and analogs of p-amino benzoic acid[3]. These are generally used as sulfa prescription and primary clinical used for diabetes[4]. These molecules have many biological activities[5] including antibacterial[6], anti-cancer[7], antiepileptics [8], anti-thyroid[9] and

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diuretic [10] activities. They have been in clinical use since 1968 [11], and are used for the treatment of glaucoma, epilepsy and heart failure [12]. A minor change in design of the medication, its biological activity is changed. Sulfonamides are antimetabolite bacteriostatic medications that cause the production of folate to be inhibited. The enzyme dihydropteroate synthetase (DHPS) is competitively inhibited by these analogues of para-aminobenzoic acid (PABA). Sulfonamides exhibit efficacy against oral anaerobes as well as certain Gram-negative, including Haemophilus influenza and Escherichia coli[13]. Sulfonamide (or sulphonamide) functional group chemistry (SN) underpins a number of pharmacological classes [14]. In biological systems, sulfonamides have traditionally been used as synthetic antifolic medicines to treat bacterial infections [15]. Procainamide is a drug used to treat Wolf-Parkinson-White syndrome, atrial fibrillation, supraventricular arrhythmias, and ventricular arrhythmias. It belongs to the drug class known as antiarrhythmic Agent Class 1A [16]. Upon oral administration, procainamide is virtually entirely absorbed, and peak plasma concentrations are typically attained in one to two hours. There is a quick initial distribution phase during intravenous delivery, and this phase lasts for almost half an hour [17]. The kidneys excrete around half of the procainamide that is given as unchanged medication. The primary metabolite, N-acetylprocainamide, has a recovery in urine of roughly 15% (range 7 to 34% in healthy persons), and it is pharmacologically active [18]. When new pharmacological therapy arrives to established treatment regimens, renal drug interactions in patients are frequently disregarded. Procainamide, N-acetylprocainamide (NAPA), and other fluoroquinolone antibiotics are removed renally through active tubular secretion [19]. Levofloxacin, one of the stereoisomers of ofloxacin, and procainamide may interact with renal systems. Procainamide's serum concentrations rise and its pharmacokinetics alter when it is taken concurrently with ofloxacin [20]. Some studies shows that the drug procainamide has various medical uses including anti-microbial and anti-inflammatory agents when used with other medications [21, 22]. So, the combination of procainamide with benzene sulfonyl chloride to prepare pronestyl sulfonamide could have anti-bacterial properties.

Since no work has so far been carried out for the synthesis of Pronestyl sulfonamide N-(2-(diethylamino)ethyl-4-(phenylsulfonamido)benzamide) and their derivatives therefore we made an attempt to evaluate these molecules for their antibacterial potential and found them moderately low inhibitors.

2. EXPERIMENTAL

2.1. General

The reagents were purchased from Alfa Aesar, Sigma Aldrich and Merck dealers were 4-Amino-N-(2-(diethylamino)ethyl) benzamide, Benzene sulfonyl chloride and distinctive alkyl/aralkyl halides.

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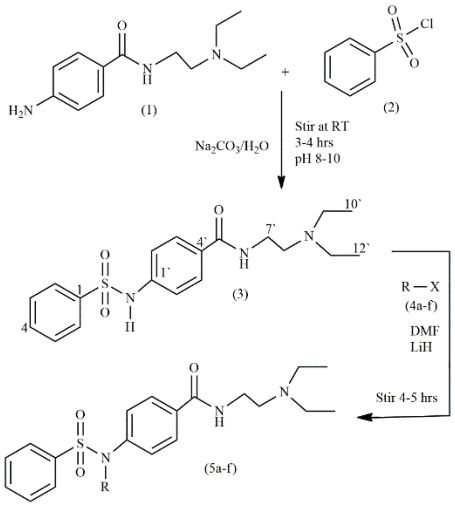
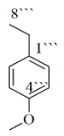
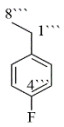
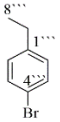


Scheme-1: Protocol for the synthesis of Pronestyl sulfonamide N-(*2-(diethylamino)ethyl-4-(phenylsulfonamido)benzamide*) (**3**) and derivatives **(5a-f).**

The purity of the prepared compounds was confirmed by using thin layer chromatography silica gel G-25UV_{254} plates in solvent system chloroform and *n*-hexane with the proportion of 1:3 and visualized under UV at 254 nm. GallenKamp melting point device was utilized to acquire melting points of parent compound and derivatives. The IR spectra were obtained by adopting KBr pellet method on a Jasco-320-A spectrometer. ^{1}H-NMR spectra were recorded in $CHCl_3$-d_1 on Bruker spectrometers at 400 MHz. Mass spectra (EIMS) were recorded on a JMS-HX-110 spectrometer with data system.

Table-1: R=Different alkyl/aryl/aralkyl electrophiles (4a-f).

Compd. No.	-R	Compd. No.	-R
(4a)	1‵‵‵ -CH2-CH3	(4d)	
(4b)		(4e)	
(4c)		(4f)	1‵‵‵ -CH2-CH2-CH3

2.2. General Procedure for the synthesis of parent compound N-2-(diethyl amino) ethyl-4-(phenylsulfonamido) benzamide (3).

4-Amino-N-(2-(diethylamino)ethyl) benzamide (1.38 g, 0.0059 mol) was added in 50 mL round bottom flask having 15 mL distilled water. The pH of the reaction mixture was

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adjusted between 8-10 by the addition of 5 mL aqueous solution of Na_2CO_3.Then Benzene sulfonyl chloride (1.04 g, 0.0059 mol) was added slowly after stirring for at least 25 minutes and stirred continuously for three to four hours. The reaction was supervised by TLC till single spot. Cold distilled water was added and pH was turned to 4-5 by adding dilute HCl, this was resulted into precipitates of reaction mixture. The precipitate of 2-(diethyl amino) ethyl-4-(phenylsulfonamido)benzamide compound were filtered, washed and dried for further use. Scheme 1 shown the general synthesis pathway.

2.2.l. N-(2-(diethylamino) ethyl)-4-(phenylsulfonamido) benzamide (3)

Yellow to off-white; Molecular Formula: $C_{19}H_{25}N_3O_3S$; Molecular Weight: 375.15gmol^{-1}; Yield: 75%, m.p 180°C, IR (KBr, ν_{max} cm^{-1}): 2930 (Ar-C-H), 1682 (C=O), 1560 (Ar C=C), 1189 (C-O), 1090 (C-N), 1440 (S=O), 3400 (N-H); ^{1}H-NMR (400 MHz, $CDCl_3$): δ(ppm) 7.85 (d, *J* = 8.03, 2H, H-2 & H-6), 7.62 (t, *J* = 8.07, 2H, H-3 & H-5), 7.70 (t, *J* = 7.65, 1H, H-4), 7.16 (d, *J* = 8.41, 2H, H-2` & H-6`), 7.53 (d, *J* = 4.46, 2H, H-3` & H-5`), 3.60 (t, *J* = 2.67, 2H, H-7`), 2.57 (t, *J* = 2.67, 2H, H-8`), 2.46 (q, *J* = 7.16, 4H, H-9` & H-11`), 1.04 (t, *J* = 7.17, 6H, H-10` & H-12`). EI-MS: m/z 377.15 [M+2] $^+$, 375.15 [M]$^+$, 360 [M-CH_3]$^+$, 289.01 [M-$C_5H_{12}N$]$^+$, 219.30 [M-$C_6H_6NO_2S$]$^+$, 141.17 [M-$C_{13}H_{20}N_3O$]$^+$, 77.10 [M-$C_{13}H_{20}N_3O_3S$]$^+$

2.3. General procedure for the synthesis of N-(2-(diethylamino) ethyl)-4-(phenylsulfonamido) benzamide derivatives (5a-f)

0.39 g (0.001039 mol) of parent compound (3) was measured and added in a 50ml round bottom flask. Reaction was carried out by using 5 mL dimethyl formamide as a solvent. LiH 0.004g (0.50 mmol) was added in the flask. The various alkyl/aryl/aralkyl electrophiles (4a-f) as shown in table.1 (0.001039 mol) were added to the flask with continues stirring for 3–4 hours for derivatives synthesis. The TLC spot ensures the purity of all compounds (5a-f). The reaction product obtained in precipitated form, precipitates additional recrystallization was carried out after washing with water.

2.3.1. N-(2-(diethylamino) ethyl)-4-(N-ethylphenylsulfonamido) benzamide (5a)

Muddy brown; Molecular Formula: $C_{21}H_{29}N_3O_3S$; Molecular Weight: 403.18 gmol^{-1}**;** Yield: 79%; m.p 184°C, IR (KBr, ν_{max}cm^{-1}): 2922 (Ar-C-H), 1678 (C=O), 1554 (Ar C=C), 1180 (C-O), 1083 (C-N), 1437 (S=O); ^{1}H-NMR (400 MHz, $CDCl_3$): δ(ppm) 7.86 (d, *J* = 8.03, 2H, H-2 & H-6), 7.63 (t, *J*=8.03, 2H, H-3 & H-5), 7.69 (t, *J* = 7.55, 1H, H-4), 6.81 (d, *J* = 8.48, 2H, H-2` & H-6`), 7.52 (d, *J* = 4.46, 2H, H-3` & H-5`), 3.90 (t, *J* = 2.67, 2H, H-7`), 2.58 (t, *J* = 2.67, 2H, H-8`), 2.46 (q, *J* = 7.16, 4H, H-9` & H-11`), 1.02 (t, *J* = 7.16, 6H, H-10` & H-12`), 1.24 (q, *J* = 6.91, 2H, H1```), 0.90 (t, *J* = 6.90, 3H, H-2) EI-MS: m/z 405.18 [M+2]$^+$, 403.18 [M]$^+$, 388 [M-CH_3]$^+$, 219 [M-$C_8H_{10}NO_2S$]$^+$, 141 [M-$C_{15}H_{29}N_3O$]$^+$, 77.09 [M-$C_{15}H_{29}N_3O_3S$]$^+$

2.3.2. N-(2-(diethylamino) ethyl)-4-(N-Phenethyl phenylsulfonamido) benzamide (5b)

Off-white amorphous powder; Molecular Formula: $C_{27}H_{33}N_3O_3S$; Molecular Weight: 479.60 gmol^{-1}**:** Yield;80%; m.p 189°C, IR (KBr, ν_{max}cm^{-1}): 2927 (Ar-C-H), 1677 (C=O), 1557 (Ar C=C), 1182 (C-O), 1086 (C-N), 1436 (S=O); ^{1}H-NMR (400 MHz, $CDCl_3$): δ(ppm) 7.86 (d, *J* = 8.03, 2H, H-2 & H-6), 7.63 (t, *J* = 8.03, 2H, H-3 & H-5), 7.72 (t, *J* = 7.55, 1H, H-4), 6.81 (d, *J* = 8.48, 2H, H-2` & H-6`), 7.53 (d, *J* = 4.46, 2H, H-3` & H-5`), 3.60 (t, *J* = 2.67, 2H, H-

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7`), 2.57 (t, *J* = 2.67, 2H, H-8`), 3.48 (q, *J* = 7.17, 4H, H-9` & H-11`), 1.02 (t, *J* = 7.16, 6H, H-10` & H-12`), 7.15 (d, *J* = 7.83, 2H, H-2``` & H-6```), 7.17 (t, *J* = 7.80, 2H, H-3``` & H-5```), 7.27 (t, *J* = 7.81, 1H, H-4```), 2.81 (t, *J* = 6.90, 2H, H-7```), 3.49 (t, *J* = 6.92, 2H, H-8```); EI-MS: m/z 481.59 $[M+2]^+$, 479.60 $[M]^+$ 393.05 $[M-C_5H_{12}N]^+$, 141.05 $[M-C_{21}H_{28}N_3O]^+$, 289.01 $[M-C_{22}H_{21}N_2O_3S]^+$, 77.08 $[M-C_{21}H_{28}N_3O_3S]^+$,

2.3.3. 4-(N-(4-bromophenethyl) phenylsulfonamido)-N-(2-(diethylamino) ethyl)benzamide (5c)

Dark brown powder; Molecular Formula: $C_{27}H_{33}BrN_3O_3S$; Molecular Weight: 557.50 $gmol^1$; Yield: 80%, m.p 193°C, IR (KBr, $\nu_{max}cm^{-1}$): 2931 (Ar-C-H), 1684 (C=O), 1565 (Ar C=C), 1191 (C-O), 1093 (C-N), 1448 (S=O); ^{1}H-NMR (400 MHz, $CDCl_3$): δ(ppm) 7.85 (d, *J* = 8.03, 2H, H-2 & H-6), 7.65 (t, *J* = 8.03, 2H, H-3 & H-5), 7.69 (t, *J* = 7.55, 1H, H-4), 7.81 (d, *J* = 8.48, 2H, H-2` & H-6`), 7.53 (d, *J* = 4.46, 2H, H-3` & H-5`), 4.60 (t, *J* = 2.67, 2H, H-7`), 2.57 (t, *J* = 2.67, 2H, H-8`), 2.46 (q, *J* = 7.16, 4H, H-9` & H-11`), 1.03 (t, *J* = 7.16, 6H, H-10` & H-12`), 7.29 (d, *J* = 7.16, 2H, H-2``` & H-6```), 7.30 (t, *J* = 5.99, 2H, H-3``` & H-5```), 3.0 (t, *J* = 6.91, 2H, H-7```), 3.5 (t, *J* = 6.92, 2H, H-8```); EI-MS: m/z 559.48 $[M+2]^+$, 557.50 $[M]^+$, 402.01 $[M-C_6H_4Br]^+$, 219 $[M-C_{13}H_{20}BrNO_2S]^+$, 141.03 $[M-C_{21}H_{28}BrN_3O]^+$, 77.01 $[M-C_{21}H_{28}N_3O_3S]^+$

2.3.4. N-(2-(diethylamino)ethyl)-4-((-4-methoxyphenethyl)phenylsulfonamido) benzamide (5d)

Yellowish gummy powder; Molecular Formula: $C_{28}H_{35}N_3O_4S$; Molecular Weight: 509.61 $gmol^{-1}$; Yield: 76%, m.p 189°C, IR (KBr, $\nu_{max}cm^{-1}$): 2960 (Ar-C-H), 1680 (C=O), 1558 (Ar C=C), 1185 (C-O), 1088 (C-N), 1437(S=O); ^{1}H-NMR (400 MHz, $CDCl_3$): δ(ppm) 7.89 (d, *J* = 8.03, 2H, H-2 & H-6), 7.66 (t, *J* = 8.03, 2H, H-3 & H-5),7.70 (t, *J* = 7.55, 1H, H-4), 6.81 (d, *J* = 8.48, 2H, H-2` & H-6`), 7.53 (d, *J* = 4.46, 2H, H-3` & H-5`), 3.60 (t, *J* = 2.67, 2H, H-7`), 2.57 (t, *J* = 2.67, 2H, H-8`), 2.46 (q, *J* = 7.16, 4H, H-9` & H-11`), 1.02 (t, *J* = 7.16, 6H, H-10` & H-12`), 7.0 (d, *J* = 8.8, 2H, H-2``` & H-6```), 6.8 (t, *J* = 6.5, 2H, H-3``` & H-5```), 3.0 (t, *J* = 6.91, 2H, H-7```), 3.5 (t, *J* = 6.92, 2H, H-8```); EI-MS: m/z 511.59 $[M+2]^+$, 509.61 $[M]^+$, 219.01 $[M-C_{13}H_{19}NO_3S]^+$, 141.01 $[M-C_{22}H_{30}N_3O_2]^+$, 77.02 $[M-C_{22}H_{30}N_3O_4S]^+$

2.3.5. N-(2-(diethylamino) ethyl)-4-(N-(4-flurophenethyl) phenylsulfonamido) benzamide (5e)

Light brown powder; Molecular Formula: $C_{27}H_{32}FN_3O_3S$; Molecular Weight: 497.61 $gmol^{-1}$**;** Yield: 75%, m.p 191°C, IR (KBr, $\nu_{max}cm^{-1}$): 2933 (Ar-C-H), 1687 (C=O), 1566 (Ar C=C), 1191 (C-O), 1100 (C-N), 1450 (S=O); ^{1}H-NMR (400 MHz, $CDCl_3$): δ(ppm) 7.83 (d, *J* = 8.03, 2H, H-2 & H-6), 7.60 (t, *J* = 8.03, 2H, H-3 & H-5), 7.73 (t, *J* = 7.59, 1H, H-4), 6.81 (d, *J* = 8.48, 2H, H-2` & H-6`), 8.53 (d, *J* = 4.45, 2H, H-3` & H-5`), 3.60 (t, *J* = 2.67, 2H, H-7`), 3.57 (t, *J* = 2.67, 2H, H-8`), 2.46 (q, *J* = 7.16, 4H, H-9` & H-11`), 1.08 (t, *J* = 7.17, 6H, H-10` & H-12`), 7.1 (d, *J* = 8.37, 2H, H-2``` & H-6```), 7.06 (t, *J* = 6.02, 2H, H-3``` & H-5```), 3.17 (t, *J* = 6.90, 2H, H-7```), 3.51 (t, *J* = 6.91, 2H, H-8 EI-MS: m/z 499.59 $[M+2]^+$, 497.61 $[M]^+$, 219.02 $[M-C_{13}H_{19}FNO_2S]^+$, 141.02 $[M-C_{21}H_{28}FN_3O]^+$, 77.03 $[M-C_{21}H_{28}N_3O_3S]^+$

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2.3.6. N-(-2-(diethylamino) ethyl)-4-(N-propylphenylsulfonamido) benzamide (5f)

Off-white powder; Molecular Formula: $C_{22}H_{31}N_3O_3S$; Molecular Weight: 417.55 $gmol^{-1}$; Yield: 81%, m.p 184°C, IR (KBr, $\nu_{max}cm^{-1}$): 2926 (Ar-C-H), 1673 (C=O), 1556 (Ar C=C), 1181 (C-O), 1084 (C-N), 1437 (S=O); ^{1}H-NMR (400 MHz, $CDCl_3$): δ(ppm) 7.81 (d, J = 8.03, 2H, H-2 & H-6), 7.63 (t, J = 8.03, 2H, H-3 & H-5), 7.71 (t, J = 7.55 ,1H, H-4), 6.81 (d, J = 8.48, 2H, H-2` & H-6`), 7.53 (d, J = 4.46, 2H, H-3` & H-5`), 3.60 (t, J = 2.67 ,2H, H-7`), 2.57 (t, $J$ = 2.67, 2H, H-8`), 2.46 (q, J = 7.16, 4H, H-9` & H-11`), 1.02 (t, J = 7.16, 6H, H-10` & H-12`), 1.23 (q, J = 6.90, 2H, H1```), 0.90 (t, J = 6.90, 3H, H-2```), 1.08 (t, J = 7.15, 3H, H-3```); EI-MS: m/z 419.54 $[M+2]^+$, 417.55 $[M]^+$, 388.03 $[M\text{-}C_2H_5]^+$, 219.28 $[M\text{-}C_{13}H_{18}NO_2S]^+$, 141.7 $[M\text{-}C_{16}H_{26}N_3O]^+$, 77.09 $[M\text{-}C_{16}H_{26}N_3O_3S]^+$

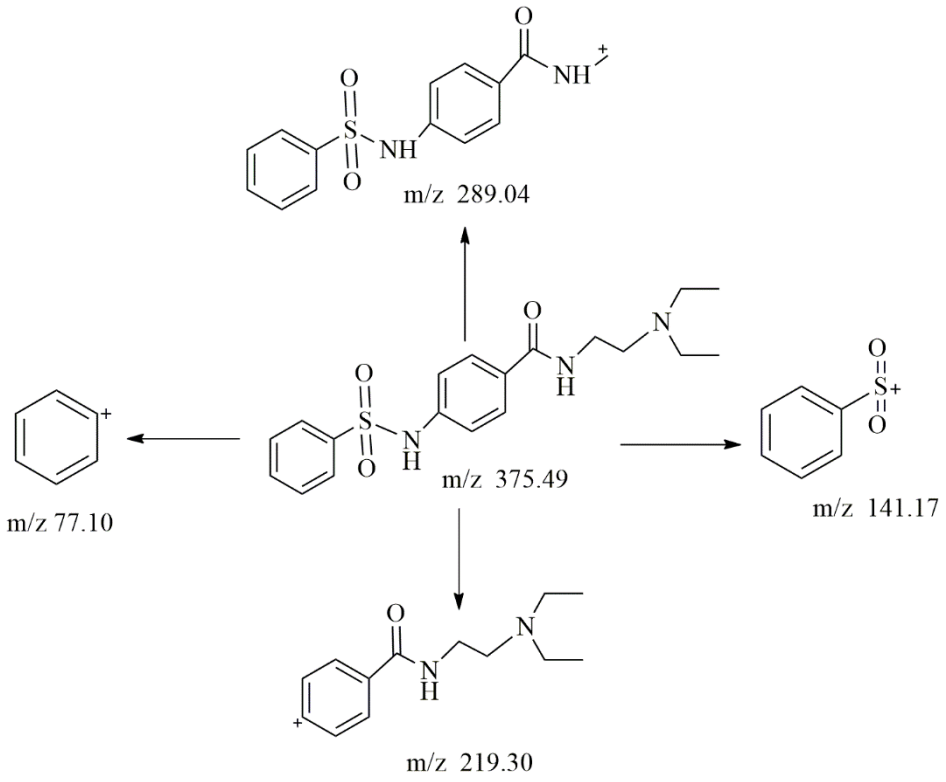

Figure 1. Fragments of parent compound.

2.4. Antibacterial Assay

The prepared mixtures were measured under aseptic conditions for anti-bacterial in clean 96-well micro plates against various bacterial strains including gram-negative (*Escherichia coli, salmonella typhi and Pseudomonas*) and gram-positive (*Bacillus subtilis and Staphylococcus aureus)*. This technique work on a particular standard which shows that with the expansion number of organisms in populace the absorbance of stock medium additionally increments. For this reason, compounds were first weakened and afterward added into wells (20µL $well^{-1}$). For development of bacterial culture supplement agar media was utilized. These new bacterial culture at that point weakened with new supplement stock and filled the wells (180µL) for measures. The temperature for the incubation kept up for 24 hours at 37°C. For

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the perception of zone of inhibition starting absorbance perusing was kept between 0.12-0.19 at 540nm with the help of micro plate perused. The all-out volume of each all-around was carefully looked after 200µL. Absorbance was estimated at 540nm and the contrast between the absorbance of test and tests mirror the bacterial development.

Table 2. Anti-bacterial activity values of Minimum Inhibitory Concentration (MIC).

Compound	***Bacillus subtilis (+)***		***Staphylococcus aureus (+)***		***Salmonella typhi (-)***		***Pseudomonas aeruginosa (-)***		***Escherichia coli (-)***	
	%age Inhibition	**(MIC)**	**%age inhibition**	**(MIC)**	**%age Inhibition**	**(MIC)**	**%age Inhibition**	**(MIC)**	**%age Inhibition**	**(MIC)**
3	74.53±1.06	76.55±2.00	72.14 ±1.42	75.43± 2.13	67.14± 1.98	25.04 ±1.64	59.32 ±3.05	63.45±2.45	63.66± 3.44	63.46± 3.45
5a	60.54±2.33	60.37 ±3.25	57.53 ±1.49	12.54 ±1.09	28.94± 6.00	42.34 ±1.34	53.32 ±2.51	14.23 ±2.03	56.56± 1.54	40.45± 5.34
5b	47.58±2.00	-	82.52 ±2.43	20.53± 3.43	21.04± 2.48	-	39.28 ±2.32	-	46.70± 3.80	-
5c	42.73±2.25	-	48.94 ±2.42	-	65.76± 1.70	21.73± 5.5	38.77 ±2.51	-	42.46± 3.15	-
5d	76.95±2.78	54.28± 1.32	75.16 ±1.36	53.28± 2.12	52.14± 3.68	51.54 ±1.54	57.06 ±1.95	65.23 ±1.32	62.00± 1.40	53.62± 1.23
5e	64.93±1.36	8.28±2 .02	71.11 ±2.42	10.29 ±1.62	55.04± 2.32	16.23± 1.74	57.32 ±1.15	9.43±1.10	59.60± 2.64	12.43± 2.12
5f	84.5±1.55	13.14± 2.11	82.16 ± 4.62	11.23 ±1.14	85.84± 2.48	12.24 ±1.93	33.64 ±3.59	-	78.40± 4.34	14.34 ±1.04
Ciprofloxacin	89.85±0.05	6.14±o .11	90.56 ±1.47	8.14±1.11	92.65± 1.11	5.24±2 .00	93.94 ±1.06	4.04±0.11	87.06± 2.34	8.84±1.19

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3. RESULTS AND DISCUSSION

The objective of this research work was to prepare the N-substituted derivatives of compound **(3)**. N-substituted derivatives **(5a-f)** have been prepared. These prepared derivatives were characterized through modern spectral procedures ^{1}H-NMR, IR and EI-MS. Their anti-microbial activity was carried in contrast to 5 Gram bacterial strains including 3 Gram – ve (*Escherichia coli, salmonella typhi* and *Pseudomonas aeruginosa*) and 2 Gram +ve (*Staphylococcus aureus and Bacillus subtilis*). All mixtures showed changing level of action yet some compounds seen as solid inhibitor against every bacterial strain.

3.1. Chemistry

Synthesis of N-*2-(diethylamino)ethyl-4-(phenylsulfonamido)benzamide* was executed by condensation reaction of *4-Amino-N-(2-(diethylamino)ethyl)benzamide* with Benzene sulfonyl chloride. The ^{1}H-NMR, IR and EI-MS was used to confirm the molecular structure of parent compound **(3)**. In EI-MS, the [M]+ peak showed at m/z 375.15. The peak at m/z 141.17 occurred due to removal of benzene sulfonyl from parent compound (3). All EI-MS fragments of parent compound (3) shown in figure 1. In IR spectrum, verification of different functional groups was recognized by comprising the occurrence of Ar-C-H group stretching vibration at 2930, carbonyl (C=O) at 1682, C=C at 1560, C-O group at 1189, C-N at 1090, S=O at 1440 and N-H group stretching at 3400. In ^{1}H-NMR, signals emerged at δ= 7.85 (d, J = 8.03, 2H, H-2 & H-6) showed downfield signals due to the electron withdrawing group of sulfonyl. Two signals at (ppm) 7.62 (t, J = 8.07, 2H, H-3 & H-5) showed meta position with respect to the sulfonyl group. Signals at (ppm) 7.70 (t, J = 7.65, 1H, H-4) showed the presence of p-substituted aniline in the compound. Two signals at(ppm) 7.16 (d, J = 8.41, 2H, H-2` & H-6`), 7.53 (d, J = 4.46, 2H, H-3` & H-5`) showed downfield signal due to the presence of amide group. Two signals at(ppm) 3.60 (t, J = 2.67, 2H, H-7`), 2.57 (t, $J$ = 2.67, 2H, H-8`) showed the presence of $–C_2H_4$ group. The up field shift appear at (ppm) 2.46 (q, J = 7.16, 4H, H-9` & H-11`), 1.04 (t, J = 7.17, 6H, H-10` & H-12`) due to the presence of $–C_2H_5$ group. All the spectral data obtained confirmed the molecular structure of **(3)** named as N-*2-(diethylamino) ethyl-4-(phenylsulfonamido)benzamide.* By the same way, all the structures of prepared molecules were affirmed by ^{1}H-NMR, IR and mass spectral data.

3.2. Antibacterial Activity

Anti-bacterial assays are written in table-1 against 5 Gram-bacterial strains. All the tested compounds exhibited strong, moderate to weak activity against given bacterial strains under study. The compound **5a** inhibit the activity of 2 bacteria *Staphylococcus aureus* and *Pseudomonus aeruginosa* while compound **5e** observed as strong inhibitor against all bacteria like, *Bacillus subtilis (*8.28±2.02), *Staphylococcus aureus (*10.29 ±1.62), *Escherichia coli (*12.43±2.12) and *Pseudomonas aeruginosa (*9.43±1.10). **5e** compound shows strong inhibition against *Salmonella typhi*. Compound **5b** did not show any inhibition activity against all the bacterial strains except *Staphylococcus aureus* with (MIC 20.53±3.43). Compound **5c** showed inhibition activity only against *Salmonella typhi* and found to be inactive against all other strains. Compound **5f** showed moderate inhibition activity against all strains and is inactive for *Pseudomonas aeruginosa.* MIC values data discussed here shown in table 2.

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4. CONCLUSION

The synthesized parent molecule and derivatives were obtained in reasonable yields and were structurally verified by spectral analysis. The antibacterial activity evaluation rendered them moderate inhibitors. Compound **5e** showed strong inhibition against all bacterial strains except *Salmonella typhi* (moderate activity). The prepared compound **(3)** and their derivatives **5a-f** would be used as best pharmacological agents for various clinical sectors.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

FUNDING DETAILS

This study did not get any financial provision.

CONFLICTS OF INTEREST

No authors have reported any competing interest.

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