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Review

Benzothiazole Congenres and It's Therapeutic Consequence: Mini statement

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Abstract:

Benzothiazole are important class of hetero compounds because it has unique and versatile scaffold for experimental design. In recent year heterocyclic compounds and their derivatives have wide range biological and pharmacological properties, Benzothiazole analogues are used in evaluating new product that possesses different biological activities. Hence their structural modification produces new derivatives causes wide range of biological and pharmacological activities such as antimicrobial, antiviral, anti-inflammatory, anti-consultant etc. This review summarises the various effect of substituent to develop new derivatives having good pharmacological properties. Benzothiazole is an organic compound bearing a heterocyclic nucleus (thiazole) which imparts a wide spectrum of biological activities to it. The significant and potent activity of benzothiazole moiety influenced distinctively by nature and position of substitutions. This review summarizes the effect of various substituents in recent trends and approaches to design and develop novel benzothiazole derivatives for anticancer potential in different cell lines by interpreting the Structure- Activity Relationship (SAR) and mechanism of action of a wide range of derivatives.

Keywords: *Benzothiazole, hetero compounds, scaffold, biological and pharmacological activities*

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INTRODUCTION

Benzothiazole is a heterocyclic ring system merged with a thiazole moiety execute an extensive range of biological activities including anticonvulsant [1], antiviral [2], antitubercular [3], antimalarial [4], anthelmintic [5], photosensitizing [6], diuretic [7], analgesic [8], anticancer [9], antimicrobial [10], antioxidant, anti-inflammatory [8] and antidiabetics [11] and other activities [12]. Benzothiazole and its derivatives (especially 2-aryl benzothiazoles) are potent radioactive imaging moieties in neurodegenerative disorders due to their amyloid-binding property [9, 13, 14]. Benzothiazole consists of thiazole ring fused with benzene ring and possess multiple applications. In 1950s, a number of 2-aminobenzothiazoles were intensively studied as central muscle relaxants. Since then, biologist's attention was drawn to this series when pharmacological profile of Riluzole (6-trifluoormethoxy-2-benzothiazolamines, Rilutek), as a Glutamate neurotransmission inhibitor was discovered. After that benzothiazole derivatives have been extensively studied and found to have diverse chemical reactivity and broad spectrum of activity 15-19.

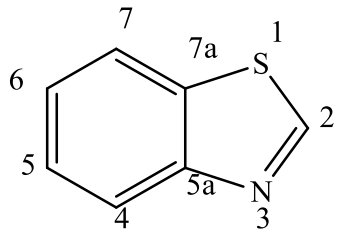
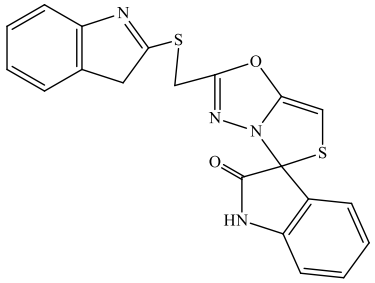


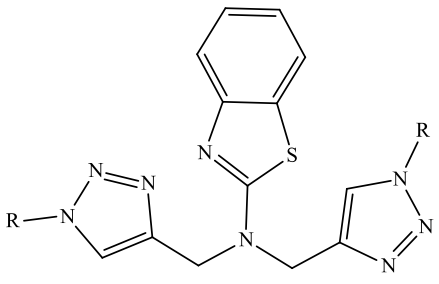
Fig.1: Benzothiazole

Derivatives of 2-aminobenzothiazoles are reported to have diverse biological activities like cytotoxicity, antiinfammatory, analgesic, anthelmintic, antiviral, antidiabetic, antimicrobial, antileishmanial, anticonvulsant, Alzheimer's disease, and calcium channel blocking [20-23]. (e present study was carried out on 6-sulfonamide containing 2-aminobenzothiazole Schi1 bases derivatives as lead molecules of the study with the aid of docking for evaluating their diuretic activity, which is an adjutant therapy in treating hypertension [24-26]. 27. Vikas S. Padalkar et. al were Synthesized and evaluated antimicrobial activity of novel 2-substituted benzimidazole, benzoxazole and benzothiazole derivatives. a derivatives of 2-(1H-benzimidazol-2-yl)-5-(diethylamino)phenol,2-(1,3-benzoxazol-2-yl)-5-(diethylamino)phenol, 2-(1,3-benzothiazol-2-yl)-5-(diethylamino)phenol and were synthesized starting from p-N,N-diethyl amino salicylaldehyde with different substituted o-phenylenediamine or o-aminophenol or o-aminothiophenol. All the synthesized compounds were evaluated for in vitro antibacterial activities against Escherichia coli and Staphylococcus aureus strains and screened in vitro antifungal activity against Candida albicans and Aspergillus niger strains by using serial dilution method. The antibacterial activities were showed as the minimum inhibitory concentration (MIC) in lg/Ml 28. Hemlata kaur et. al synthesized, characterize and screened biological activity of various substituted benzothiazole derivatives.



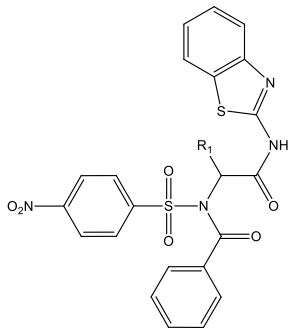
(1)

Manavendra K. Singh et.al were designed, synthesized and antimicrobial activity of novel benzothiazole analogues. They designed and synthesized a new class of antimicrobials, dialkyne substituted 2-aminobenzothiazole that was reacted with various substituted aryl azides to generate a small collection of 20 compounds (3set) by click chemistry [29]. These compounds were tested for their antibacterial activity against Gram bacteria (Staphylococcus aureus and Enterococcus faecalis), Gram negative bacteria (Salmonella typhi, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Shigella boydii) and antifungal activity against Candida tropicalis, Candida albicans, Candida krusei, Cryptococcus neoformans) as well as molds (Aspergillus niger, Aspergillus fumigatus). The compound 1e showed maximum potency against all gram bacterial strains with MIC value 3.12 mg/ml, that is twofold more active as compared to standard drug ciprofloxacin (MIC 6.25 mg/ml.



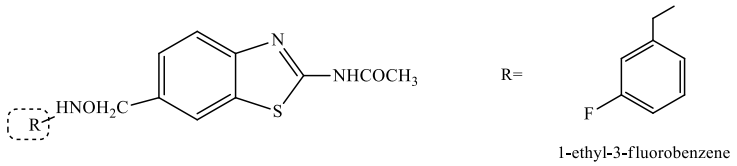
1e

David Izuchukwu Ugwu et.al synthesized and evaluated novel molecular docking studies of anti-inflammatory and analgesic agents of benzothiazole derivatives by in vivo. Twelve new derivatives of benzothiazole bearing benzene sulphonamide and carboxamide were synthesised and investigated in vivo anti-inflammatory, analgesic [30] and ulcerogenic activities. Molecular docking expressed an excellent binding interaction of the synthesised compounds with the receptors, with 1c showing the highest binding energy (–12.50 kcal/mol). Compound 1c and 1i causes prohibited carrageenan induced rat paw oedema at 72, 76, and 80% and 64, 73, and 78% at 1 h, 2 h, and 3 h, respectively.



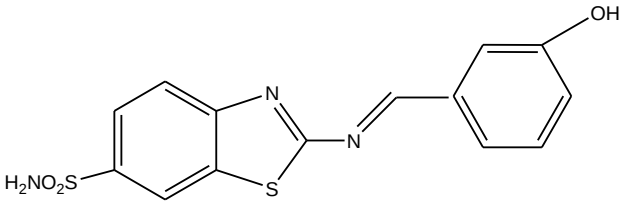
(1)

Gnanavel Sadhasivam et.al were synthesized, characterized, and evaluated of anti-inflammatory and anti-diabetic activity of new benzothiazole derivatives. A series of new benzothiazole derivatives were synthesized and evaluated for anti-inflammatory and anti-diabetic activity. Compounds structures were confirmed by 1H-NMR,13C-NMR, FT-IR, and LC-MS. The compounds 1 also showed good anti-inflammatory activity[30].



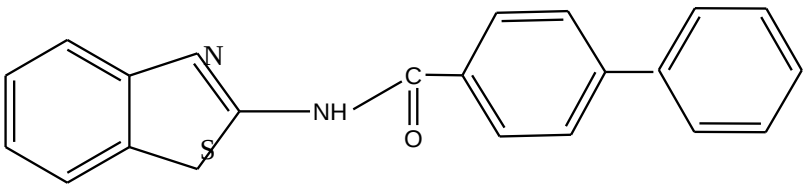
(1)

Durgaprasad Kemisetti et.al synthesized and analysed novel benzothiazole derivatives as Diuretic Agents. All compound recrystallized, characterized, and tested for diuretic efficacy in vivo by ,using different online tools, m.p. (melting point), Rf, FTIR (Fourier transform infrared), 1H-NMR (proton nuclear magnetic resonance) data are analysed, Autodock is another online tool to analyse the data of benzothiazole derivatives[32]. Acetazolamide was shown to have a diuretic effect that was superior to that of compounds Ib, whereas 2-{(E)-[(3-hydroxyphenyl) methylidene] amino}-1,3-benzothiazole-6-sulfonamide (IIIb) was found to be the most promising potential.



Ib

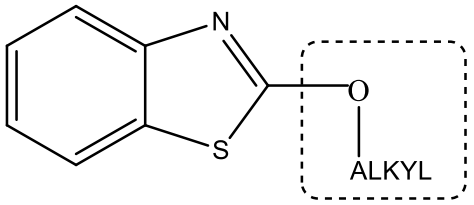
Mohammad shahar yar et.al were synthesized and screened in vivo diuretic activity of biphenyl benzothiazole-2-carboxamide derivatives. A series of N-{(substituted)1,3-benzothiazol-2-yl}-1,1'-biphenyl-4-carboxamides were synthesized by reaction between biphenyl acid chloride and 2-aminobenzothiazole[33]. The synthesized compounds were evaluated in vivo for diuretic activity. Among the series, N-(1,3-benzothiazol-2-yl)-1, biphenyl-4-carboxamide (1) was found to be the most promising candidate.



(1)

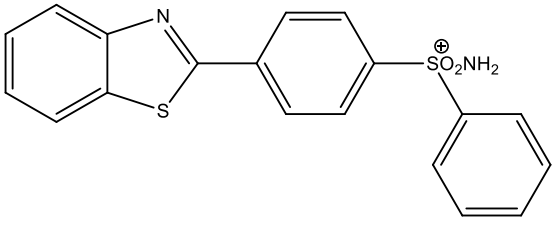
Zehra Ku c,u kbay et.al synthesized, characterized novel benzothiazole derivatives and evaluated biological carbonic anhydrase inhibitory activity . N-protected amino acids were reacted with substituted benzothiazoles to give the corresponding N-protected amino acid-benzothiazole conjugates (60–89%). Their structures were confirmed by proton nuclear magnetic resonance (1H NMR), carbon-13 nuclear magnetic resonance (13C NMR), IR and elemental analysis.[34].

Qinghao Jin et.al were synthesized of Benzo[d]Thiazol-2(3H)-One Derivatives and evaluated their antidepressant and anticonvulsant effects. Thirty-four new benzo[d]thiazol derivatives were synthesized and screened their antidepressant and anticonvulsant effects. compound 1 showed the maximum antidepressant and anticonvulsant effects compared with standard drug fluoxetine.



1

36. Sukhbir L. Khokra et.al were Synthesized and studied Computational parameter and evaluated anticonvulsant Activity of Novel Benzothiazole Coupled Sulfonamide Derivatives. Benzothiazole were synthesized by ¾ substituted with benzene sulphonamide linked via phenyl ring by condensation of 2-(3/4-aminophenyl) benzothiazole with various substituted sulfonyl chlorides, the two series of title compounds namely N-(4-(benzothiazole-2-yl) phenyl) 4- substituted benzene sulphonamides and N-(4-(benzothiazole-2-yl) phenyl3- substituted benzene sulphonamides were synthesized. Compound 1 showed as the most potent anticonvulsant agent against maximal electroshock (MES) model.



(1)

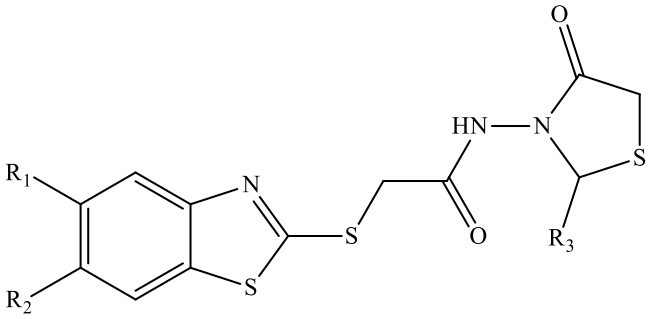
37.Bharti Chauhan et. al. were designed, synthesized, In Vivo, and In silico evaluation of Benzothiazoles Bearing a 1,3,4-Oxadiazole Moiety as new antiepileptic Agents. A new series of 2-[4-methoxy-3-(5-substituted phenyl-[1,3,4]oxadiazol-2-ylmethoxy)-
phenyl]-benzothiazoles were synthesized and studied in vivo and in silico for their anticonvulsant potential. Maximum electroshocks (MES) and subcutaneous pentylenetetrazol (PTZ) models have been used for in vivo anticonvulsant activity.

38. Chetna Kharbanda et.al Twenty-eight benzothiazole based sulfonylureas/sulfonyl thioureas were synthesized and were screened for their antidiabetic effect in a glycaemic rat model by the in vivo oral glucose tolerance test. All the synthesized compounds were studied by interactions with PPAR-γ receptor site through a docking

study. Subsequently, in vitro PPAR-γ transactivation assay was performed on ten active compounds. All synthesized compounds showed moderate to good antidiabetic activity.

39. Ninad V. Puranik et.al reported antidiabetic potential and enzyme kinetics of benzothiazole derivatives by non-bonded interactions with alpha glucosidase and alpha amylase. Benzothiazole derivatives were synthesized and evaluated antidiabetic potential by using α-glucosidase, α-amylase, non-enzymatic glycosylation of haemoglobin and advanced glycation end product inhibition assays.

40. Sunil Kumar et. al were studied biological assessments of substituted benzothiazole derivatives in streptozocin induced diabetes rats Some benzothiazole were synthesized by the streptozocin induced diabetes rat model, among them compound 1d exhibited more potent anti-diabetic activity at 350 mg/kg p.o.



1d

CONCLUSION

All synthesized derivatives show good to moderate biological activities. Review furnishes that benzothiazole derivatives displayed various pharmacological properties. Further modification in its main nucleus of benzothiazole derivatives produces efficient derivatives with good biological properties.

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