EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 11
Issue: 7
55-59
Year: 2024

# A REVIEW ON SYNTHESIS AND BIOLOGICAL EVALUTION OF BENZIMIDAZOLE DERIVATIVES

**Akash Mishra*, Gyan Singh, Anadi Tiwari, Jitendra Malik, Sunil Kumar, Prachi Gupta**

Faculty of Pharmacy, P.K. University Village Thanra District Shivpuri (M.P), Pin-473665.

***Corresponding Author: Akash Mishra**
Research Scholar, Faculty of Pharmacy, P.K. University Village Thanra District Shivpuri (M.P), Pin-473665.

**Article Received on 06/05/2024** **Article Revised on 27/05/2024** **Article Accepted on 17/06/2024**

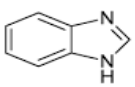
**ABSTRACT**
In the pharmaceutical industry uses benzomidazole, a heterocyclic organic molecule with a significant pharmacophoric group. FTIR spectroscopy was utilized to establish the existence of certain groups. Benzimidazole derivatives, with their multitude of pharmacological actions, are essential in the medical area. include antibacterial, antiviral, anthelmintic, antidiabetic, and anticancer properties. The creation of certain more potent and important compounds was aided by the effectiveness of these therapeutically relevant medications in treating microbial infections and other conditions. Extensive biochemical and pharmacological research has demonstrated the remarkable effectiveness of benzomidazoles against a variety of microorganism strains. The purpose of this paper is to provide an overview of the chemistry of various derivatives of modified benzimidazoles and their pharmacological properties. The benzimidazole nucleus is employed as a preferred structural motif in the creation of a broad spectrum of pharmaceuticals with potential applications in several therapeutic domains.

**KEYWORDS:-** Benzimidazole, anticancer, FTIR spectroscopy, microbial infections.

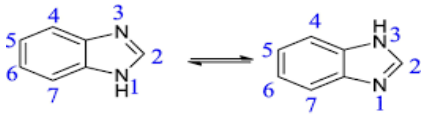
## INTRODUCTION

In medicinal chemistry, benamidazole is a significant heterocyclic aromatic organic molecule with a unique structure and pharmacophore. It is bicyclic in nature and is made up of a fused benzene ring and an imidazole ring with two nitrogen atoms at neighboring positions.

Nitrogen molecule and the place of N is in 1 st and 3 rd. position of the atom. Being a major comprise of different normal items, including purine, receptor, histidine and nucleic corrosive, benzimidazole subsidiaries have involved a one of a kind spot in the field of restorative science, subsequently fuse of the benzimidazole core to get ready or combination novel benzimidazole subsidiaries has continuously conveyed the consideration of numerous restorative physicist and consequently ended up being crucial manufactured methodology in durg revelation.



Benzimidazole



Acidc nature Basic nature

Benzimidazole subsidiaries is utilized in various ways like antibacterial antimicrobial, antifungal, antiviral, hostile to helmenthic, anticonvulsant anticancer, antihypertensive, antiphrastic avtivity Right off the bat benzimidazole was combined by Hoebrecker in 1872, who got 2, 5(or 2, 6)- dimethylbenzimidazole by the utilizing of 2-nitro-4-methylacetanilide.

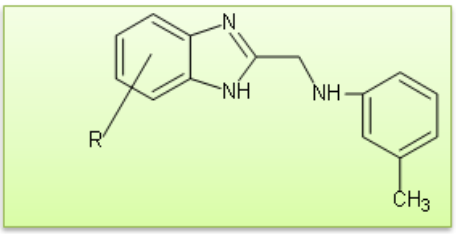
## PHYSICAL CHARACTERISTICS

Benzimidazole is Amphotric in nature, benzimidazole functions as an acid and a base.
Molecular formula: C7H6N2
Molecular weight : 118.14 g/mol
Melting point : 1700C -1720C
Activity (PKa) : 12.8(for benzimidazole) & 5.6 (for the conjugate acid)

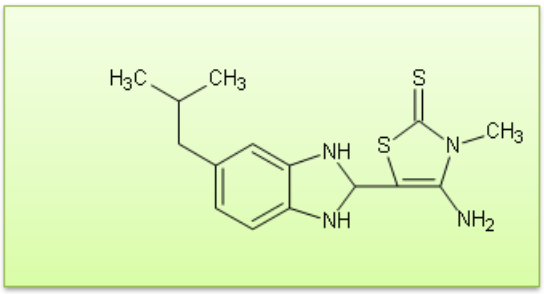
## BIOLOGICAL EVALUTION AND SYNTHESIS OF BENZIMIDAZOLE

Achar KC have revealed the combinations of N-subbed Benzimidazole subordinates. Newly combined combinations were assessed for pain relieving & anti-incendiary effort. Against staphylococcus aureus, Bacillus subtilis, E-curl, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion framework. The combination 2-methylaminobenzimidazole outgrowth was acquaint with

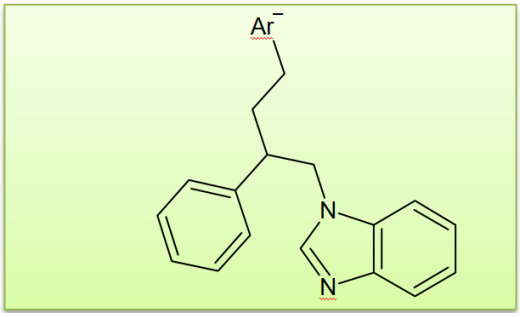
be more dynamic pain relieving & anti-provocative blend than othercompound. In-vivo pain relieving andanti-provocative molding of as of late integrated benzimidazole side-effects.



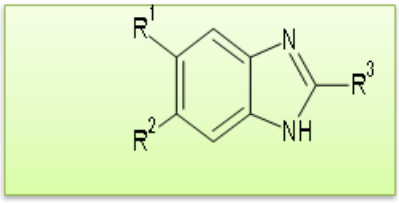

HananM. Refaat have announced the combinations of N-subbed Benzimidazolederivatives. Newly blended emulsion were assessed for anticancer effort. Against staphylococcus aureus, Bacillus subtilis, E-curl, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion framework. The emulsion 2-( (4-oxothiazolidin-2-ylidene) methyl and (4-amino2- thioxothiazol-5-yl) benzimidazoles determinations was acquaint with be more dynamic anticancer dynamic emulsion than other emulsion. The blended items were subjected to in vitro anticancer webbing that uncovered that every one of the tried composites delivered antitumor effort. NH NH H3C CH3 S N S.



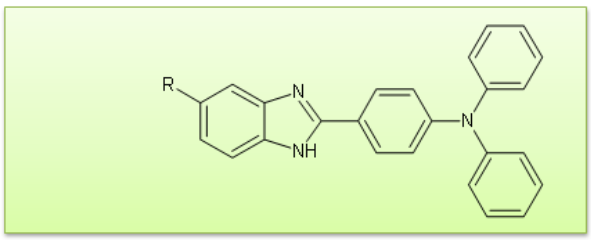

O¨zdenO¨zelGu¨ven, have detailed the combinations of N-subbed Benzimidazolederivatives. Newly blended blend were assessed for anticancer effort. Against staphylococcus aureus, Bacillus subtilis, E-curl, pseudonomous as aenginosa (Gram Negative) and candida Albicans and Aspergillus Niger by two dilusion framework. The blend 3-(2-phenylpropyl)- 1H-indole benzimidazoles deductions was plant to be more dynamic anticancer dynamic combination than other emulsion.



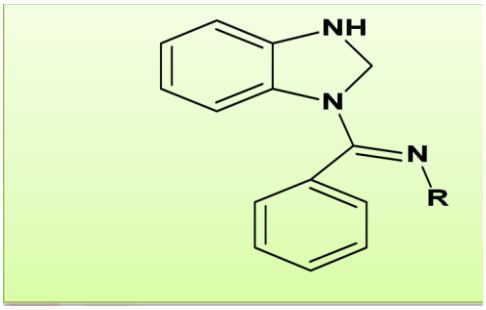

The blends of N-substituted Benzimidazole derivatives have been described by Juan Valdez. A newly created emulsion was evaluated for its antiparasitic efficacy. Using two deception systems, it is effective against Staphylococcus aureus, Bacillus subtilis, E-coil, candida albicans, and Aspergillus nigrum, which are all pseudonomous as aenginosa (Gram Negative). It was observed that the emulsion 2-methoxycarbonylamino derivations benzimidazoles outgrew other emulsions in terms of antiparasitic activity. Interpretation and Antiparasitic Use of 1H-Benzimidazole Compounds. Composites 1 through 14 have been created and examined in vitro against the helminth Trichinella spiralis, Entamoeba histolytica, and protozoa Giardia lamblia.




N-substituted Benzimidazole derivations have been reported to be confused by Jiaxu Fu. Natural exertion was assessed using a recently manufactured combination. employs two deception systems to combat Aspergillus Niger, Candida albicans, Bacillus subtilis, E-coil, and pseudonomous as aenginosa (Gram Negative). The combination of N, N-dimethylformamide benzimidazole derivatives was shown to be a more naturally occurring, active emulsion than any other combination. Fryer-supported convolution and spontaneous effort in the fluorescent portions of mono- and di-fanned benzimidazole derivatives replaced with diphenylamine.




The confusion of N-substituted Benzimidazole derivations has been described by Asma Eswayah. Analgesic exertion was measured using a recently synthesized emulsion. Using two deception systems, it is effective against Staphylococcus aureus, Bacillus subtilis, E-coil, candida albicans, and Aspergillus nigrum, which are all pseudonomous as aenginosa (Gram Negative). Compared to other mixtures, the N-acylated benzimidazole combination was shown to be a more potent anticancer active emulsion. Evaluation of Some Novel Benzimidazole Derivations for Conflation and Analgesic Exertion.




## BIOLOGICAL SIGNIFICANCE

### Antimalarial activity

350–500 million clinical episodes were caused by malaria. each year and result in more over a thousand fatalities, the majority of which have an impact on children younger than five years old in sub-Saharan Africa. Protozoal infection is the fifth reason for infectious disease-related deaths globally. According to recent estimates, up to 3.3 billion people sleep in 109 countries in settings where they could contract protozoa infections. In addition to its negative health effects, protozoal infections have a significant economic impact on endemic nations and exacerbate the cycle of poverty that people experience throughout multiple nations.

Protozoal infection mortality and morbidity started to rise in the 1980s due to a number of factors, including the emergence of humanitarian crises in several malaria-endemic areas, the weakening of antimalarial medication and pesticide resistance in parasites, the rapid decentralization and integration into failing primary health care systems, and the growth of parasite and vector resistance. This sharp rise indicates the urgent need for novel protozoal infections with entirely distinct methods of action from the ones that exist now, as well as the identification of novel therapeutic targets. It has recently been demonstrated that chloroquine inhibits the development of hemozoin within the parasite food cavity. Certain quinoline antimalarial drugs are also believed to target this mechanism at the molecular level.

### Antifungal activity

Over the past few decades, irresistible diseases have become more and more debilitating to human welfare. The resistance of certain microorganisms to different medications is becoming more common, especially for Gram-positive microscopic organisms and certain resistant parasites. The decreasing sensitivity to antimicrobial operators in current use has also been increasing for an astounding variety of pathogens. (WHO) has established a superb track record of recovery for Candida contaminations and has emerged as the key choice in the management of illnesses caused by Cryptococcus neoformans and Candida albicans because to their favorable pharmacokinetic properties, strong activity, and excellent wellbeing profile. However, fluconazole is not fungicidal and does not work against obtrusive aspergillosis.

The increasing prevalence of fluconazole-safe C. albicans detaches is also a result of the widespread clinical use of the drug. This combination of novel spiro [indolethiazolidinones] has been tested in vitro for contagiousness against Rhizoctoniasolani, Fusarium oxysporum, and Collectotrichum.

### Antiviral activity

Persistent hepatitis C virus infection (HCV) may pose a significant risk for the development of cancer and liver disease. About one-third of people on the planet have chronic HCV infection. There is now no prophylactic vaccine, and the limitations of the medical profession include significant side effects and treatment durations of forty-eight weeks with only a five hundredth sustained medication response rate. The discovery that an infectious virus system could support the transfection of human malignant hepatoma cells with genomic HCV ribonucleic acid (JFH1) isolated from a patient with abrupt liver illness was a significant breakthrough in recent times. It is possible to study the HCV life cycle at every stage using this cell culture model. The antiviral characteristics of many benzimidazole derivatives have been reported in an unprecedented number of experiments using entirely distinct virus strains, such as the human herpes virus (HCMV), the human immunodeficiency virus, the viral hepatitis C virus, and the human immunodeficiency virus. Furthermore, amidino-substituted benzimidazoles, such as bis(5-amidino-2-benzimidazolyl) paraffin (BABIM), shown the capacity to inhibit cell fusion induced by the metastasis syncytial (RS) virus. Furthermore, it was demonstrated that adding the amidino moiety to the benzimidazole ring has strong antibacterial and anti-protozoal effects.

### Antiproliferative activity

It has been observed that substituted aromatic aldehydes and 2-aminobenzimidazole derivatives are new Schiff bases. The Mixtures formed 2-benzyl aminobenzimidazoles when reduced by NaBH4, which were then acylated by cinnamonoyl chloride to produce 2-(o-bromobenzylamino)-1-cinnamoylbenzimidazo autoimmune illness. The antiproliferative activity of the substances was assessed in vitro.

### Antitumor activity

There are rumors that a number of novel nitrobenzimidazoles have cytotoxic potential against cancer. inside the purported analysis The fact that substances like thiadiazole, tetrazole, triazines, and imidazoles also have activity was unquestionably acknowledged.

### Anti-inflammatory activity

The process produced a number of 2-methylaminobenzimidazole compounds that were described. The newly created synthetic molecules were tested for their ability to reduce pain and inflammation using mice's writhing and rats' paw oedema caused by

carrageenan. An further study shown that when combined with iodole Skelton, benimidazole has a strong anti-inflammatory effect akin to that of indomethacin.

**Antioxidant activity**

There have been reports of several dihydrochloride-containing substances having antioxidant properties; these salts also exhibit modest platelet and antiaggregant action of erythrocytes. By inhibiting 5-lipoxygenase, it was shown that combining a trimethyl group with benzimidazole also added antioxidant properties.

**Antiprotozoal activity**

There have been reports of several dihydrochloride-containing substances having antioxidant properties; these salts also exhibit modest platelet and antiaggregant action of erythrocytes. By inhibiting 5-lipoxygenase, it was shown that combining a trimethyl group with benzimidazole also added antioxidant properties.

**Androgen Receptor antagonist**

Five and six dichloride benzimidazole derivatives are more benzimidazole derivatives. It was discovered that the trifluoromethyl group significantly increases antagonistic activity in the prostrate. A well-known non-steroidal antiandrogen for the treatment of androgen-dependent prostate cancer is belicutamide.

**Anti convulsant Agents**

There have been reports of a number of 1, 2, 5-trisubstituted benzimidazole derivatives, and some possible anticonvulsant chemicals that have been produced. The anticonvulsant action of the synthesized compounds is attributed to the optimal chain length at position two (R2), rather than the linker at position one (R1), according to the findings of the QSAR inquiry and the analysis of various physicochemical parameters. The outcomes additionally demonstrated that, in line with QSAR research, synthetic compounds containing an electron-withdrawing group, like nitro at position five (R3), have been reported to exhibit superior anticonvulsant action.

## CONCLUSION

A versatile heterocyclic patch with several pharmacological conditionings is benamidazole. Research on the confusion of various Benzimidazole derivatives and an assessment of their innate conditioning are therefore necessary. A promising class of bioactive heterocyclic molecules with a range of biological activities, including anti-microbial, antiviral, anti-inflammatory, and anti-cancer properties, are believed to be benzomidazoles. The biology and chemistry of the several substituted benzimidazole spinoffs are compiled in this thorough overview.

## REFERECNCES


1. Walia R, Hedaitullah MD, Naaz SF et.al Benzimidazole derivatives–an overview. Int. J. Res. Pharm. Chem., 2011; 1(3): 565-74.
2. HS. Lamba et. al., Benzimidazole derivatives: Spectrum of pharmacological activity and toxicological properties. Pharmaceutical Chemistry Journ.
3. Afaf H. et.al. Synthesis and Antimicrobial Activity of Some New Benzimidazole Derivatives. Molecules, 2000; 5: 1429–1438.
4. Khalid Iqbal et.al. Studies of antimicrobial activity of Benzimidazole derivatives–an overview. Int. J. Res. Pharm. Chem., 2011; 1(3): 565-74.
5. Juan Valdez, et.al., Synthesis and Antiparasitic Activity of 1H-Benzimidazole Derivatives. Bioorganic & Medicinal Chemistry Letters, 2002; 12: 2221–2224.
6. Achar KC, Hosamani KM, Seetharamareddy HR.et.al., In-vivo analgesic and anti-inflammatory activities of newly synthesized benzimidazole derivatives. European journal of medicinal chemistry, May. 1, 2010; 45(5): 2048-54.
7. Hanan M. Refaat et.al., Synthesis and anticancer activity of some novel 2-substituted benzimidazole derivatives European Journal of Medicinal Chemistry, 2010; 45: 2949e2956.
8. O¨ zden O¨ zel Gu¨ven, a, et.al., Synthesis and antimicrobial activity of some novel phenyl and benzimidazole substituted benzyl ethers Bioorganic & Medicinal Chemistry Letters, 2007; 17: 2233–2236.
9. Asma Eswayah, et.al., Synthesis and Analgesic Activity Evaluation of Some New Benzimidazole Derivatives American Journal of Chemistry and Application, 2017; 4(5): 30-35.
10. Muhammad Tahaa, et.al., Synthesis, α-glycosidase inhibitory potential and molecular docking study of benzimidazole derivatives.
11. Azize Gizem Uslua et.al., Benzimidazole derivatives as potent and isoform selective tumor-associated carbonic anhydrase IX/XII inhibitors Bioorganic Chemistry, 2020; 95: 103544.
12. Jiaxu Fu, et.al., Microwave-assisted synthesis and luminescent properties of triphenylamine substituted mono- and di- branched benzimidazole derivatives. Chemical papers, 240-340.
13. Tianrong Zhang, et.al., Design, synthesis and biological activity evaluation of novel methyl substituted benzimidazole derivatives T. Zhang et al. / Tetrahedron, 2020; 76: 131027.
14. Cakir B, Yildirim E, Ercanli T, Erol K, Sahin MF. Synthesis and anticonvulsant activity of some (2:4-substituted) benzaldehyde(2-oxobenzothiazolin-3-yl) acetohydrazones, Farmaco, 1999; 54: 842–845.
15. Kapuriya K, Ganure A, Davda S, Kitawala M and Topiya H. Benzimidazole: A promising Lead for AntiCancer Drug Design. UJP., 2013; 02(03): 57-62.
16. Patil A, Ganguly S and Surana S. A systemic review of benzimidazole derivatives as an antiulcer agent. Rasayan Journal of Chemistry, 2011; 1(3): 447-460.
17. Budow S, Kozlowska M, Gorska A, Kazimierczuk Z, Eickmeier H, Colla PL, Gosselin G and Seela F.. Substituted benzimidazoles: anti-viral activity and

synthe-sis of nucleosides. ARKIVOC, 2009; iii: 225-250.
18. Cong C, Wang H, Huc C, Liu C, Ma S, Li X, Cao J and Ma S. Synthesis and antibacterial activity of novel 400-Obenzimidazolyl clarithromycin Derivatives. Eur J Med Chem., 2011; 46: 3105-3111.
19. Cvetkovic SOPKDD. Lipophilicity and anti-fungal activity of some 2- substituted benzimidazole derivatives. Chem Ind & Chem Eng Quart, 2011; 17(1): 9-15.
20. Elnima EI, Zubair M and Badar AA. Antibacterial and antifungal activities of benzimidazole and benzox-azole derivatives. Antimicrob. Agents Chemother, 1981; 19(1): 29-32.
21. Fang B, Zhou CH and Rao X.C. Synthesis and biological activities of novel aminederived bis-azoles as potential antibacterial and anti-fungal agents. Eur J Med Chem., 2010; 45: 4388-4398.
22. Gomez HT, Nunez EH, Rivera IL, Alvarez JG, Rivera RC, Puc RM, Ramos AR, Gutierrez MDR, Bacab MJC and Vazquez GN. Design, synthesis and in vitro antiprotozoal activity of benzimidazolepentamidine hybrids. Bioorg & Med Chem Lett., 2008; 18: 3147–3151.
23. Grocer H, Kus C, Boykin DW, Yildiz S and Altanlar N. Synthesis and Antifungal Properties of Some Benzimidazole Derivatives. Bioorg. Med. Chem., 2002; 10: 2589–2596.
24. Grocer H, Kus C, Boykin DW, Yildiz S and Altanlar N. Synthesis and Antifungal Properties of Some Benzimidazole Derivatives. Bioorg Med Chem., 2002; 10: 2589–2596.
25. Gupta HC and Jaiswal V. Synthesis and Anti-viral Activity of Some New benzimidazoles. J Ind Council Chem., 2010; 27(2): 159-162.
26. Haugwitz RD. Anti-parasitic agents Synthesis and anti-helmintic activities of novel 2-substituted isothiocyanatobenzoxazoles and benzimidazole. J Med Chem., 1982; 25: 969-974.