3.3.2. Number of research paper published per teacher in the journals notified on UGC care list during the 2023-2024

S.No.	Title of paper	Name of the author/s	Name of journal
01	Bio-Analytical method development and validation of Asciminib and its application to pharmacokinatic studies in rat plasma by using RP-HPLC	Dr R Vijayalakshmi	Asian Journal of Chemistry. 2023, 35 (7), 1651-1658 https://doi.org/10.14233/ajchem.2023.27925
02	Syringodium isoetifolium Fosters an antioxidant defense system, modulates glycolytic enzymes and protects membrane integrity in DEN-induced hepatocellular carcinoma in Albino wistar rats.	Dr. D. Kavitha	Indian Journal of Pharmaceutical Education and Research 2023, 57, s690-s700 https://archives.ijper.org/article/2083
03	Syringodium isoetifolium Fosters an antioxidant defense system, modulates glycolytic enzymes and protects membrane integrity in DEN-induced hepatocellular carcinoma in Albino wistar rats.	M.D. Dhanaraju	Indian Journal of Pharmaceutical Education and Research 2023, 57, s690-s700 https://archives.ijper.org/article/2083
04	Syringodium isoetifolium Fosters an antioxidant defense system, modulates glycolytic enzymes and protects membrane integrity in DEN-induced hepatocellular carcinoma in Albino wistar rats.	Dr. C Gopi	Indian Journal of Pharmaceutical Education and Research 2023, 57, s690-s700 https://archives.ijper.org/article/2083

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05	Syringodium isoetifolium Fosters an antioxidant defense system, modulates glycolytic enzymes and protects membrane integrity in DEN-induced hepatocellular carcinoma in Albino wistar rats.	Dr T Deepan	Indian Journal of Pharmaceutical Education and Research 2023, 57, s690-s700 https://archives.ijper.org/article/2083
06	Syringodium isoetifolium Fosters an antioxidant defense system, modulates glycolytic enzymes and protects membrane integrity in DEN-induced hepatocellular carcinoma in Albino wistar rats.	Dr V Alekhya	Indian Journal of Pharmaceutical Education and Research 2023, 57, s690-s700 https://archives.ijper.org/article/2083
07	Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole Mannich Base Derivatives	Dr C. Gopi	Asian Journal of Chemistry 2024, 36(4),969-973 https://doi.org/10.14233/ajchem.2024.31314
08	Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole Mannich Base Derivatives	Dr. M.D. Dhanaraju	Asian Journal of Chemistry 2024, 36(4),969-973 https://doi.org/10.14233/ajchem.2024.31314
09	Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole Mannich Base Derivatives	Mrs. K. Pranusha	Asian Journal of Chemistry 2024, 36(4),969-973 https://doi.org/10.14233/ajchem.2024.31314
10	Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole	Dr T Deepan	Asian Journal of Chemistry 2024, 36(4),969-973 https://doi.org/10.14233/ajchem.2024.31314

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	Mannich Base Derivatives		
11	Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole Mannich Base Derivatives	Dr. AR Magesh	Asian Journal of Chemistry 2024, 36(4),969-973 https://doi.org/10.14233/ajchem.2024.31314
12	Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole Mannich Base Derivatives	Dr. Kavitha	Asian Journal of Chemistry 2024, 36(4),969-973 https://doi.org/10.14233/ajchem.2024.31314
13	An Overview of Highly Efficient Prodrug Strategies in Design, Development, Bioactive Pathway and Recent Therapeutic Applications	Dr. C Gopi	Indian Journal of Pharmaceutical Sciences 2024;86(2):381-391 Doi: 10.36468/pharmaceutical-sciences.1289
14	An Overview of Highly Efficient Prodrug Strategies in Design, Development, Bioactive Pathway and Recent Therapeutic Applications	Dr M.D. Dhanaraju	Indian Journal of Pharmaceutical Sciences 2024;86(2):381-391 Doi: 10.36468/pharmaceutical-sciences.1289
15	Enhancement of Non-Heme Iron Absorption from Vegetable Foods by using Vitamin-C supplements in Wistar Rats	Dr S Ramachandran	Research J. Pharm. and Tech 2024; 17(5):2224-2228 Doi: [illegible]
16	Enhancement of Non-Heme Iron Absorption from Vegetable Foods by using Vitamin-C supplements in Wistar Rats	C Gopi	Research J. Pharm. and Tech 2024; 17(5):2224-2228 Doi: [illegible]

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17	Enhancement of Non-Heme Iron Absorption from Vegetable Foods by using Vitamin-C supplements in Wistar Rats	Dr M.D. Dhanaraju	Research J. Pharm. and Tech 2024; 17(5):2224-2228 Doi: 10.52711/0974-360X.2024.00350
18	Comparison of efficiency of myoinositol/D-chiro inositol versus myoinositol/metformin in the management of polycystic ovrian syndrome	Dr S Ramam,	Eur Chem Bull, 2023, 12(10), 3118-3126. Doi: 10.48047/ecb/2023.12.10.215
19	Comparison of efficiency of myoinositol/D-chiro inositol versus myoinositol/metformin in the management of polycystic ovrian syndrome	Dr P Himasree,	Eur Chem Bull, 2023, 12(10), 3118-3126. Doi: 10.48047/ecb/2023.12.10.215
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22	Comparison of efficacy among the migraine patients prescribed with Flunarizine, Propranolol and petasites in the management of severity of pain and disability	Dr S Ramachandran	J Popul The Clin Pharmacol 2023, 30(11), e265-e270. https://doi.org/10.47750/jptcp.2023.30.11.027

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23	Comparison of efficacy among the migraine patients prescribed with Flunarizine, Propranolol and petasites in the management of severity of pain and disability	Dr M.D. Dhanaraju	J Popul Ther Clin Pharmacol 2023, 30(11), e265-e270. https://doi.org/10.47750/jptcp.2023.30.11.027
24	Design and Evaluation of Telmisartan-Loaded Nanosponges for Hypertension Treatment Advances in Bioresearch	Dr Vankayala Devendiran Sundar	Advances in Bioresearch 2024, 15(4): 01-13. Doi:10.15515/abr.0976-4585.15.4.113
25	Design and Evaluation of Telmisartan-Loaded Nanosponges for Hypertension Treatment Advances in Bioresearch	Dr M.D. Dhanaraju	Advances in Bioresearch 2024, 15(4): 01-13. Doi: 10.15515/abr.0976-4585.15.4.113
26	Design and Evaluation of Telmisartan-Loaded Nanosponges for Hypertension Treatment Advances in Bioresearch	Mr. V Anilkumar	Advances in Bioresearch 2024, 15(4): 01-13. Doi: 10.15515/abr.0976-4585.15.4.113
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28	Biomedical applications of nanomaterials in the advancement of nucleic acid therapy: Mechanistic	Dr V. D. Sundar	International Journal of Biological Macromolecules 241 (2023) 124582. https://www.sciencedirect.com/science/

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30	Novel Clarithromycin Loaded Self Emulsifying Drug Delivery System for Amplification of Solubility and Oral Bioavailability.	Dr R. Vijayalakshmi	Der Pharma Chemica, 2023, 15(4): 5-13
31	Novel Clarithromycin Loaded Self Emulsifying Drug Delivery System for Amplification of Solubility and Oral Bioavailability.	Dr M.D. Dhanaraju	Der Pharma Chemica, 2023, 15(4): 5-13
32	Formulation And Evaluation Of Self Microemulsifying Drug Delivery System Of Carvedilol	Dr Vankayala Devendiran Sundar	Eur. Chem. Bull. 2023, 12 (Special Issue 4), 16025-16036 https://www.eurchembull.com/archives/volume-12/special%20issue-4/7151
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35	Formulation And Evaluation Of Self Microemulsifying Drug Delivery System Of Carvedilol	Mr. V Anil kumar	Eur. Chem. Bull. 2023, 12 (Special Issue 4), 16025-16036 https://www.eurchembull.com/archives/volume-12/special%20issue-4/7151
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39	Gellan Gum-Based Hydrogel for The Transdermal Delivery of Naproxen Sodium: Statistical Optimization and In-Vitro Evaluation.	Mr. V. Anilkumar	Advances in Bioresearch, 2023, 14(6): 272-279 https://soeagra.com/abr/abrnov2023/35.pdf
40	Gellan Gum-Based Hydrogel for The Transdermal Delivery	Dr. Vankayala Devendiran Sundar	Advances in Bioresearch, 2023, 14(6):

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49	Formulation and Evaluation of Lamivudine Niosomes by thin Film Hydration Technique	Dr M.D. Dhanaraju	Journal of Chemical Health Risks, 2023, 13(4): 992-1000. https://www.jchr.org/index.php/JCHR/article/view/996/854
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55	Design and Characterization of Lamivudine Niosomal Drug Delivery System.	Mr. V. Anilkumar	Bull. Env. Pharmacol. Life Sci, 2023, 13(1): 45 -56. https://www.bepls.com/dec_2023/7.pdf
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58	Response Surface Design for Formulation and Evaluation of Floating Oral In Situ Gelling System Of Famotidine For Ulcer	Mr. V. Anilkumar	Bull. Env. Pharmacol. Life Sci, 2023, 13(1): 97 -107.
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60	Response Surface Design for Formulation and Evaluation of Floating Oral In Situ Gelling System Of Famotidine For Ulcer	Dr. Vankayala Devendiran Sundar	Bull. Env. Pharmacol. Life Sci, 2023, 13(1): 97 -107. https://bepls.com/dec_2023/13.pdf

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61	Formulation Development and Evaluation of Pulsatile Drug Delivery System of Hydrochlorothiazide.	Dr M.D. Dhanaraju	African Journal of Biological Sciences. 2024: 6(14), 7940-7960. https://doi.org/10.48047/AFJBS.6.14.2024.7940-7960
62	Formulation Development and Evaluation of Pulsatile Drug Delivery System of Hydrochlorothiazide.	Dr. Vankayala Devendiran Sundar	African Journal of Biological Sciences. 2024: 6(14), 7940-7960. https://doi.org/10.48047/AFJBS.6.14.2024.7940-7960
63	Formulation Development and In vitro Evaluation of Lovastatin Nanosponges by Emulsion Solvent Evaporation Method.	Dr M.D. Dhanaraju	Advances in bioresearch Vol 15 [4] July 2024 : 38-49 https://bepls.com/dec_2023/6.pdf
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Bio-Analytical Method Development and Validation of Asciminib and its Application to Pharmacokinetic Studies in Rat Plasma by Using RP-HPLC

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The aim of the proposed study was to validate a rapid, uncomplicated, accurate, robust and sensitive bio-analytical method for quantifying asciminib using ivosidenib as an internal standard in rat plasma. This work provides a summary of recent advances in bio-analytical HPLC methodologies employing a Luna phenyl hexyl column (150 × 4.6 mm, 3.5) with an organic mobile phase of potassium dihydrogen phosphate (adjusted to pH 3.0 with orthophosphoric acid) and acetonitrile in the ratio 40:60. With a correlation coefficient of 0.999, the asciminib calibration curve was linear over the range of 100-2000 ng/mL. Using liquid-liquid extraction, the percent of recovered ASB ranged between 97.8 and 99.9%. The plasma stability of the bench-top and auto sampler remained stable for 24 h in the auto sampler. The $T_{1/2}$ is 5 h and T_{max} is 3 h, as calculated from the pharmacokinetic parameters. The application indicates that all parameters of system suitability, specificity, linearity and accuracy are in good agreement with the prescribed limits; consequently, the current method is highly stable, rapid and capable of analyzing plasma samples. This method is ideally adapted for determining asciminib in pure or dose form due to its novel technology.

Keywords: Asciminib, Validation, HPLC, Rat plasma, Pharmacokinetics.

INTRODUCTION

Asciminib is a small molecule drug developed by Novartis for the treatment of chronic myeloid leukaemia [1,2], which has been approved by the US FDA in 2021. It is also known as Scemblix, which is N-[4-(chloro-difluoro-ethoxy)phenyl]-6-[(3*R*)-3-hydroxy-pyrrolidin-1-yl]-5-(1*H*-pyrazol-3-yl)pyridine-3-carboxamide hydrochloride with the chemical formula $C_{23}H_{21}N_5O_3ClF_2$.HCl [3]. It works by selectively targeting and inhibiting a specific mutant form of the BCR-ABL1 protein [4], which is the cause of chronic myeloid leukaemia. Asciminib is unique among chronic myeloid leukaemia treatments in that it targets a different part of the BCR-ABL1 protein than other tyrosine kinase inhibitors like imatinib, nilotinib and dasatinib [4]. This means that asciminib can be effective in patients who have developed resistance to other tyrosine kinase inhibitors. Clinical trials have shown that asciminib is effective in treating chronic myeloid leukaemia [5,6], including in patients who have developed resistance to other tyrosine kinase inhibitors. It has also been found to have a favourable safety profile, with fewer side effects compared to other tyrosine kinase inhibitors [7,8]. Asciminib represents a promising new treatment option for chronic myeloid leukaemia patients, particularly those who have developed resistance to other tyrosine kinase inhibitors. However, more research is needed to fully understand its efficacy and safety profile and to determine its optimal use in clinical practice. Bioanalytical method development using HPLC [9-13], is significant in determining the concentration of drugs and their metabolites in biological samples. It ensures the safety and efficacy of drugs by providing accurate and precise measurements, facilitating drug development and enabling pharmacokinetic studies. Only one study has been published on the determination of asciminib by UHPLC till now. In the study by Priya *et al.* [14], asciminib was separated proficiently using C18 column operated with mobile phase trifluoro acetic acid in water (0.1%) and acetonitrile in the ratio of 75:25 v/v achieved retention time of 0.925 min and linearity of 0.999.

Till today there is no established bioanalytical method for the determination of asciminib in various biological matrices.

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Original Article

Syringodium isoetifolium Fosters an Antioxidant Defense System, Modulates Glycolytic Enzymes and Protects Membrane Integrity in DEN-induced Hepatocellular Carcinoma in Albino Wistar Rats

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ABSTRACT

Background: *Syringodium isoetifolium* seagrass has bioactive constituents with potential pharmacological uses, but their use is limited owing to scarce scientific evidence. The *in vivo* anti-cancer activity of *Syringodium isoetifolium* against DEN-induced hepatocellular carcinoma in Wistar albino rats is described in this work for the first time. **Materials and methods:** Wistar albino rats were used as test subjects to examine the anti-cancer properties of *Syringodium isoetifolium* against DEN-induced hepatocellular carcinoma at the dose of 50 mg/kg body weight. The experimental rats were split into five groups (Group I-V). Except for group I, remaining all animals received DEN and Phenobarbitone during the experiment. Group I and Group II acted as normal and diseased control groups respectively. The extracts were administered to the satellite group III and IV orally with the dose of 250 and 500 mg/kg body weight respectively. 5 Fluorouracil 20mg/kg was administered to group V orally and considered as a standard. The total experimental period lasted for 14 weeks. **Results:** The findings show that *Syringodium isoetifolium* significantly reduces liver tumor volume, burden and numbers in experimental rats ($p<0.05$) when compared to the control group. Besides, the extracts treated groups restored the pathological parameters close to normal values ($p<0.05$). The histological analysis also showed that the extract-treated animals' livers had recovered their normal architecture. **Conclusion:** The study concludes that *Syringodium isoetifolium* inhibits the cancer growth in hepatocellular carcinoma by altering the antioxidant defense system, glycolysis and protecting the membrane architecture by inhibiting the elevated levels of haematological, biochemical parameters and biomarker values.

Keywords: *Syringodium isoetifolium*, Hydroalcoholic extract, Wistar albino rats, Toxicology report, Hepatocellular carcinoma.

INTRODUCTION

By 2030, 17 million individuals will die from cancer, with 26 million of those cases occurring largely in developing and impoverished nations.[1,2] According to the International Agency for Cancer Research, 7,84,821 persons died from cancer in India alone in 2018, accounting for 6% of all cancer related fatalities.[3] One of the cancer forms with the greatest rate of growth in India is liver cancer, a potentially fatal condition.[4] More than 1 million people worldwide suffer from this prevalent dangerous cancer, which resulted in 800,000 fatalities in 2018.[5] There was a 114.0% rise in liver cancer incident cases.[6] Despite notable advancements in treatments and prevention measures, it has been a continuing fight around the world.[7] The cancer treatment options include surgery, radiation, chemotherapy, targeted therapy, immunotherapy, bone marrow transplant and hormone therapy which are among the possible cancer treatments.[8,9] One of the main problems with the development of traditional anti-cancer medications is the onset of multidrug resistance and relapse.[10] Herbal medicines to treat disease and enhance the general health and well-being of a person.[11] In the recent past, evidence suggests that they should be employed as an alternative to traditional therapies.[12,13] Cancer therapy is increasingly being acknowledged as an effective adjunct to the use of medicinal plants and their phytoconstituents.[14] Seagrasses are blooming plants that flourish in bays and other shallow coastal environments.[15] The biomass of seagrass has been utilized

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Syringodium isoetifolium Fosters an Antioxidant Defense System, Modulates Glycolytic Enzymes and Protects Membrane Integrity in DEN-induced Hepatocellular Carcinoma in Albino Wistar Rats

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ABSTRACT

Background: *Syringodium isoetifolium* seagrass has bioactive constituents with potential pharmacological uses, but their use is limited owing to scarce scientific evidence. The *in vivo* anti-cancer activity of *Syringodium isoetifolium* against DEN-induced hepatocellular carcinoma in Wistar albino rats is described in this work for the first time. **Materials and methods:** Wistar albino rats were used as test subjects to examine the anti-cancer properties of *Syringodium isoetifolium* against DEN-induced hepatocellular carcinoma at the dose of 50 mg/kg body weight. The experimental rats were split into five groups (Group I-V). Except for group I, remaining all animals received DEN and Phenobarbitone during the experiment. Group I and Group II acted as normal and diseased control groups respectively. The extracts were administered to the satellite group III and IV orally with the dose of 250 and 500 mg/kg body weight respectively. 5 fluorouracil 20mg/kg was administered to group V orally and considered as a standard. The total experimental period lasted for 14 weeks. **Results:** The findings show that *Syringodium isoetifolium* significantly reduces liver tumor volume, burden and numbers in experimental rats ($p<0.05$) when compared to the control group. Besides, the extracts treated groups restored the pathological parameters close to normal values ($p<0.05$). The histological analysis also showed that the extract-treated animals' livers had recovered their normal architecture. **Conclusion:** The study concludes that *Syringodium isoetifolium* inhibits the cancer growth in hepatocellular carcinoma by altering the antioxidant defense system, glycolysis and protecting the membrane architecture by inhibiting the elevated levels of haematological, biochemical parameters and biomarker values.

Keywords: *Syringodium isoetifolium*, Hydroalcoholic extract, Wistar albino rats, Toxicology report, Hepatocellular carcinoma.

INTRODUCTION

By 2030, 17 million individuals will die from cancer, with 26 million of those cases occurring largely in developing and impoverished nations.[1,2] According to the International Agency for Cancer Research, 7,84,821 persons died from cancer in India alone in 2018, accounting for 6% of all cancer-related fatalities.[3] One of the cancer forms with the greatest rate of growth in India is liver cancer, a potentially fatal condition.[3] More than 1 million people worldwide suffer from this prevalent dangerous cancer, which resulted in 800,000 fatalities in 2016.[4] There was a 114.0% rise in liver cancer incident cases.[4] Despite notable advancements in treatments and prevention measures, it has been a continuing fight around the world.[5] The cancer treatment options include surgery, radiation, chemotherapy, targeted therapy, immunotherapy, bone marrow transplant and hormone therapy which are among the possible cancer treatments.[6,7] One of the main problems with the development of traditional anti-cancer medications is the onset of multidrug resistance and relapse.[8,9] Herbal medicines to treat disease and enhance the general health and well-being of a person.[10] In the recent past, evidence suggests that they should be employed as an alternative to traditional therapies.[11,12] Cancer therapy is increasingly being acknowledged as an effective adjunct to the use of medicinal plants and their phytoconstituents.[13] Seagrasses are blooming plants that flourish in bays and other shallow coastal environments.[14] The biomass of seagrass has been utilized

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Original Article

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Original Article

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ASIAN JOURNAL OF CHEMISTRY

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Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole Mannich Base Derivatives

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In present work, the newly synthesized benzimidazole Mannich base derivatives were design, synthesized and evaluated the *in silico* and *in vitro* antitubercular activity. These compounds were synthesized by condensation reaction between 1-(1*H*-benzo[*d*]imidazol-1-yl)ethanone and aliphatic/aromatic amines. The synthesized compound structures were identified by FTIR, ^{13}C NMR, ^{1}H NMR and mass spectroscopies. The results indicated that these derivatives have significant antitubercular activity against *Mycobacterium tuberculosis* (M.tb) cell wall enzyme enoyl acyl carrier protein reductase (InhA), EthR regulatory protein in H37Rv strain. The results found in the *in vitro* study are firmly similar to the *in silico* study. Among the synthesized compounds, **3d** and **3e** exhibited the highest activity due to the connection of the electron-donating group to the Mannich base. Therefore, these compounds deserve the development of new antitubercular agents.

Keywords: Benzimidazole, Mannich base, Aliphatic/aromatic amines, Antitubercular activity.

INTRODUCTION

According to the literature study, benzimidazole and its derivatives have an enormous role in the preparation of novel pharmaceuticals [1-3]. The parent component of the series is commonly referred to as benzimidazole, however benzoglyoxaline is frequently used as an alternative term [4]. This moiety plays a critical role in diverse pharmacological benefits such as antitumour [5], antiviral [6], antimicrobial [7], antifungal [8], antihelminthic [9], anti-inflammatory [10], antihistaminic [11], proton pump inhibitor [12], antioxidant [13], antitubercular activity [14]. In the same way, Mannich bases have an excellent therapeutic profiles, relatively safe and well-tolerated molecules [15,16]. Ketone, aldehyde and a primary and secondary amine form a complex molecule called Mannich base [17,18].

Mannich bases also act as vital pharmacophores which are employed for the preparation of different therapeutic agents holding the group of aminoalkyl chains [19]. They offered various pharmacological benefits, such as anti-inflammatory [20], anticancer [21], antipyretic [22], antibacterial [23], antifungal [24], anthelmintic [25], anticonvulsant [26], analgesic [27], antitubercular [28], anti-HIV [29], antimalaria [30], antiviral agent [31], antipsychotic [32], *etc.* Some of the medicinal compounds having Mannich base are fluoxetine, atropine and ranitidine, *etc.* The above benefits and our interest in the synthesized compounds containing benzimidazole and Mannich base encourage us to synthesize a series of the novel benzimidazole Mannich base derivatives. These compounds were produced from needed materials and the construction of the structures was recognized by different spectral studies and screened for tuberculosis by using *in vitro* and *in silico* methods. The experimental outcome recommended that all Mannich base derivatives showed excellent antitubercular activity against *Mycobacterium tuberculosis*. The therapeutic activity of the synthesized Mannich base derivatives (**3a-e**) is similar to standard drugs.

EXPERIMENTAL

The chemicals and solvents were acquired from leading pharma companies like Sigma, Alrich, Ranbaxy and Dr. Reddy.

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CHANDRAVADIVELU GOPI[1,*], MAGHARLA DASARATHA DHANARAJ[2], KONATHAM PRABUSHA[1], THIYAGARAJAN DEEPAN[1], AR MAGESH[3] and DHANARAJU KAVEERA[1]

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Mannich bases also act as vital pharmacophores which are employed for the preparation of different therapeutic agents holding the group of aminoalkyl chains [19]. They offered various pharmacological benefits, such as anti-inflammatory [20], anticancer [21], antipyretic [22], antibacterial [23], antifungal [24], anthelmintic [25], anticonvulsant [26], analgesic [27], antituberculor [28], anti-HIV [29], antimalaria [30], antiviral agent [31], antipsychotic [32], *etc*. Some of the medicinal compounds having Mannich base are fluoxetine, atropine and ranitidine, *etc*. The above benefits and our interest in the synthesized compounds containing benzimidazole and Mannich base encourage us to synthesize a series of the novel benzimidazole Mannich base derivatives. These compounds were produced from needed materials and the construction of the structures was recognized by different spectral studies and screened for tuberculosis by using *in vitro* and *in silico* methods. The experimental outcome recommended that all Mannich base derivatives showed excellent antitubercular activity against *Mycobacterium tuberculosis*. The therapeutic activity of the synthesized Mannich base derivatives (**3a-e**) is similar to standard drugs.

EXPERIMENTAL

The chemicals and solvents were acquired from leading pharma companies like Sigma, Alrich, Ranbaxy and Dr. Reddy

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Design, Synthesis, Characterization and Antitubercular Activity of Novel Benzimidazole Mannich Base Derivatives

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In present work, the newly synthesized benzimidazole Mannich base derivatives were design, synthesized and evaluated the *in silico* and *in vitro* antitubercular activity. These compounds were synthesized by condensation reaction between 1-(1*H*-benzo[*d*]imidazol-1-yl)ethanone and aliphatic/aromatic amines. The synthesized compound structures were identified by FTIR, ^{13}C NMR, ^{1}H NMR and mass spectroscopies. The results indicated that these derivatives have significant antitubercular activity against *Mycobacterium tuberculosis* (Mtb) cell wall enzyme enoyl acyl carrier protein reductase (InhA), EthR regulatory protein in H37Rv strain. The results found in the *in vitro* study are firmly similar to the *in silico* study. Among the synthesized compounds, **3d** and **3e** exhibited the highest activity due to the connection of the electron-donating group to the Mannich base. Therefore, these compounds deserve the development of new antitubercular agents.

Keywords: Benzimidazole, Mannich base, Aliphatic/aromatic amines, Antitubercular activity.

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Review Article

An Overview of Highly Efficient Prodrug Strategies in Design, Development, Bioactive Pathway and Recent Therapeutic Applications

G. CHANDRAVADIVELU* AND D. D. MAGHARLA

Research lab, GIET School of Pharmacy, Rajahmundry, Andhra Pradesh 533296, India

A prodrug is a chemically inert drug precursor, which upon biotransformation liberates the pharmacologically active parent compound. It is also called proagent, latentiated drug, bio reversible derivative and congeners. There are several reasons to utilize prodrug strategy in drug design. The drug is insufficient in solubility, absorption, distribution, lack of target site-specificity, prolonged-release, toxicity, instability, poor acceptance and formulation issues can be made to prodrug. The concept of prodrug acts as a significant alternative to solve pharmaceutical and pharmacokinetic-related problems of drug molecules. Though a few studies have been concerned with some aspects of prodrugs, surprisingly there is no review on the complete information about prodrug and their recent applications. In the present study, an attempt had been made on the design, synthesis, development, bioactive pathway and latest research findings of newly synthesized prodrugs and their therapeutic uses.

Key words: Drug design, prodrug, synthesis and development, bioactive pathway, recent therapeutic applications

The word Prodrug was introduced by Adrien Albert in 1951 and the concept was identified by Harper in 1959[1,2]. According to Harper, the word latentiated indicating to drugs that need bioactivation[3]. This description is the most suitable even at present moment and is consistent with the International Union of Pure and Applied Chemistry (IUPAC) definition which states that a prodrug is a biologically inactive molecule that is altered into an energetic active drug by an enzymatic or chemical process[4]. It is also called a bio-reversible derivative, latentiated drug, pro-agent and congeners etc.,[5-12]. Many enzymes involving the activation of prodrugs are oxidoreductases like DT-diaphorase, β-glucuronidase, carboxylesterase and Cytochrome P450 (CYP450)[8-10]. Pharmaceutical scientists are often facing serious formulation problems including inadequate oral absorption, poor solubility, instability, rapid metabolism, short half-life and toxicity[11-13]. These problems lead to the growth of a comparatively great number of prodrugs. The healing power of the prodrug is enhanced by not only minimizing the unacceptable and harmful properties but also by maintaining the high selectivity on the targeted site[14,15]. In addition to that several prodrugs have gained massive experimental success in clinical studies. Therefore, the prodrug approach is quickly becoming a fundamental part of the drug discovery process. At present, 5 %-8 % of the therapeutic agents are categorized as prodrugs, and around 15 % of all new drug compounds are synthesized each year as prodrugs[16]. Prodrugs have been utilized in a broad diversity of therapeutic areas including antiulcer[17], analgesic[18,19], anti-hypertension[19], anti-influenza[20], anti-biotics[21], anticoagulant[22], antifungal[23], anticancer[24], anti-inflammatory[25] and anaesthetic agents[26].

In recent years, many scientists were prepared different prodrug molecules through carrier-linked and chemical modification[27,28]. But, there is no review concerning the complete information including the recent progress of prodrugs and their therapeutic activities. Therefore, the present work

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RJPT

RESEARCH ARTICLE

Enhancement of Non-Heme Iron Absorption from Vegetable Foods by using Vitamin-C supplements in Wistar Rats

Somasundaram Ramachandran[1]*, Ramya Manthena[1], Chandravadivelu Gopi[2], Magharla D Dhanaraja[3]

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ABSTRACT:
Anemia is associated with increased morbidity and mortality in women and children. It causes a poor birth outcome, decline in mental ability, weakness and affects the reproductive age of women. The objective of this study is to assess the enhanced absorption of non-heme iron by using foods rich in Vitamin-C. Anemia was induced by intraperitoneal administration of 60mg/kg phenylhydrazine in rats. Later they were fed with heme iron food, non-heme iron food and non-heme iron food along with vitamin-C rich food supplements for 28 days according to the designated groups . Group 1(Negative control), Group 2(Positive control), Group 3(Heme food), Group 4(Non-heme food) and Group 5(Non-heme food along with Vitamin-C food supplements). On the last day, the blood sample was collected from the rats by retro orbital puncture and analysed. The result reveals that there is a steep increase of iron absorption in non-heme iron food along with vitamin-C food supplements group and the level of red blood cell, haemoglobin and red blood cell indices were compared with rats treated with heme food. The vitamin-C food supplements enhanced iron absorption in non-heme iron food by forming a chelate with ferric iron at an acid pH that remains soluble at the alkaline pH of the small intestine. Therefore the study strongly recommended that the usage of vitamin-C rich food supplements along with non-heme food enhances the absorption of iron in vegetable foods.

KEYWORDS: Non-heme food, Vitamin-C supplement, Chelation, Increases Non-heme iron absorption.

INTRODUCTION:

Anemia is a condition in which there is a lack of healthy red blood cells (RBC) to hold adequate oxygen to the body's tissues[1,2,3]. There are many types of anemia such as iron deficiency anemia, sickle cell anemia, anemia of inflammation, aplastic anemia, hemolytic anemia, and vitamin deficiency anemia that affect people, each with their own causes[4,5,6]. Iron deciency anemia is the most common type of anemia[7]. Adult male and females of average height have about 4 and 3.5 grams of iron in their body[8]. Almost two-thirds of the body's iron is found in the haemoglobin, which serves a vital role in carrying oxygen from the lungs to body cells[9,10].

The body cannot produce iron and must acquire it from food[11,12]. Therefore, we must take foods that are loaded with iron such as red meat, poultry, pork, seafood, dark green leafy vegetables, beans, cereals, dried fruit and peas[13,14]. Heme iron is found in animal products and is generally absorbed easily[15,16,17]. But, non-heme iron presented in vegetarian foods is not as easily absorbed[18]. Therefore, vegetarian people have a much higher risk of iron deficiency anemia than their nonvegetarian counterparts[19,20]. Here, the recent research suggested that vitamin-C facilitates non-heme iron absorption by making a chelate or complex with ferric iron at an acid pH that remains soluble at the alkaline pH of the small intestine[21,22]. It is the only food constituent other than the animal product that has been shown to facilitate the absorption of iron[23,24]. It is an effective way to manage iron deficiency in vegetarian people. Later, the blood plasma protein called transferrin acts a central role in

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Anemia is associated with increased morbidity and mortality in women and children. It causes a poor birth outcome, decline in mental ability, weakness and affects the reproductive age of women. The objective of this study is to assess the enhanced absorption of non-heme iron by using foods rich in Vitamin-C. Anemia was induced by intraperitoneal administration of 60mg/kg phenylhydrazine in rats. Later they were fed with heme iron food, non-heme iron food and non-heme iron food along with vitamin-C rich food supplements for 28 days according to the designated groups . Group 1(Negative control), Group 2(Positive control), Group 3(Heme food), Group 4(Non-heme food) and Group 5(Non-heme food along with Vitamin-C food supplements). On the last day, the blood sample was collected from the rats by retro orbital puncture and analysed. The result reveals that there is a steep increase of iron absorption in non-heme iron food along with vitamin-C food supplements group and the level of red blood cell, haemoglobin and red blood cell indices were compared with rats treated with heme food. The vitamin-C food supplements enhanced iron absorption in non-heme iron food by forming a chelate with ferric iron at an acid pH that remains soluble at the alkaline pH of the small intestine. Therefore the study strongly recommended that the usage of vitamin-C rich food supplements along with non-heme food enhances the absorption of iron in vegetable foods.

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The body cannot produce iron and must acquire it from food[9,10]. Therefore, we must take foods that are loaded with iron such as red meat, poultry, pork, seafood, dark green leafy vegetables, beans, cereals, dried fruit and peas[10,11]. Heme iron is found in animal products and is generally absorbed easily[9,10,12]. But, non-heme iron presented in vegetarian foods is not as easily absorbed[10]. Therefore, vegetarian people have a much higher risk of iron deficiency anemia than their nonvegetarian counterparts[9,10]. Here, the recent research suggested that vitamin-C facilitates non-heme iron absorption by making a chelate or complex with ferric iron at an acid pH that remains soluble at the alkaline pH of the small intestine[11-16]. It is the only food constituent other than the animal product that has been shown to facilitate the absorption of iron[13-16]. It is an effective way to manage iron deficiency in vegetarian people. Later, the blood plasma protein called transferrin acts a central role in

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COMPARISON OF EFFICACY OF MYOINOSITOL/D-CHIRO INOSITOL VERSUS MYOINOSITOL/METFORMIN IN THE MANAGEMENT OF POLY CYSTIC OVARIAN SYNDROME

Authors

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RESEARCH ARTICLE
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Comparison Of Efficacy Among the Migraine Patients Prescribed With Flunarizine, Propranolol And Petasites In The Management Of Severity Of Pain And Disability

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ABSTRACT

Aim: To compare the efficacy among the migraine patients prescribed with flunarizine, propranolol and petasites in the management of severity of pain and disability.

Methods: A total of 90 patients who were recruited in this study were categorized into three groups i.e., group A, B & C where flunarizine, propranolol and petasites were prescribed respectively. The severity of pain and disability among the three groups were assessed by using the visual analogue scale (VAS) and migraine disability assessment test (MIDAS questionnaire) before and after the treatment with respective drugs.

Results: Among the group-A subjects, the mean VAS score was observed to be 8.46 (±2.01) before the treatment and was reduced to 4.43 (±1.67) with a mean score difference of 4.03 ($p<0.0001$*) where as in case of group-B subjects, the mean VAS score was observed to be 8.33(±1.93) before the initiation of the treatment and was reduced to 5.40 (±1.65) with a mean score difference of 2.93 ($p<0.0001$*) and in case of group-C subjects, the mean VAS score was observed to be 7.83 (±1.87) before the initiation of treatment and was reduced to 5.26 (±2.01) with a mean score difference of 2.57 ($p<0.0001$*). Among the group-A subjects, the mean MIDAS score was observed to be 15.67 (±5.38) before the initiation of the treatment and was reduced to 11.0 (±4.16) with a mean score difference of 4.67 ($p=0.0004$*) whereas in case of group-B subjects, the mean MIDAS score was observed to be 12.07 (±3.99) before starting the treatment and was reduced to 7.9 (±2.64) with a mean score difference of 4.17 ($p<0.0001$*) and in case of group-C subjects, the mean MIDAS score was observed to be 13.77 (±5.40) before the initiation of the treatment and was reduced to 9.83 (±5.20) with a mean score difference of 3.94 ($p=0.0036$*).

Conclusion: In this study, a highest reduction of the mean VAS score and mean MIDAS score was observed in the group-A subjects who were prescribed with flunarizine when compared to the group-B and group-C subjects who were prescribed with propranolol and petasites respectively. It is the responsibility of the clinical pharmacists to get involved in the pharmaceutical care of the migraine.

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Advances in Bioresearch

ORIGINAL ARTICLE

Design and Evaluation of Telmisartan-Loaded Nanosponges for Hypertension Treatment

Vankayala Devendiran Sundar[1*], Magharla Dasaratha Dhanaraju[2], Anilkumar Vadaga[3], Suri N S V Madhulatha[4]

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ABSTRACT

The Nanosponges of Telmisartan were prepared using the solvent evaporation method. PLGA, Tween80, Glutaraldehyde, Pluronic used a polymer. Acetone was used as the solvent. The prepared nanosponges were evaluated for various parameters, revealing intriguing results regarding the efficient preparation of the nanosponge. F7 outperforms the other nine formulations with its results. Entrapment efficiency measures the percentage of the drug that is successfully encapsulated within the nanosponge structure relative to the initial amount used. The values range from 82% to 98%, indicating generally high effectiveness in drug encapsulation across all formulations. Notably, F7 exhibits the highest entrapment efficiency at 98%, while F1 shows the lowest at 82%. The particle sizes of Telmisartan loaded nanosponges for nine different formulations (F1 through F9). The particle sizes range from 110 nm to 190 nm. The smallest particle size is observed in formulation F4 (110 nm), and the largest in F9 (190 nm). The data indicates that F7 is an optimized formulation with a consistent and rapid release profile compared to the other formulations. Starting from an initial 0% at time 0, F7 exhibits a significant release of 23.16% at 1 hour, which continues progressively. By hour 5, F7 achieves a release of 68.78%, and by hour 7, it reaches 78.36%. The release percentage of F7 continues to increase, reaching 89.75% at hour 9, 94.36% at hour 10, and finally achieving a near-complete release of 98.39% at hour 12. The release pattern of F7 shows a steady and sustained increase, indicating its effective and controlled release characteristics, making it the optimized formulation among the nine compared.

Keywords: Telmisartan, PLGA, Pluronic, Acetone, Nanosponges

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INTRODUCTION

Nanosponges are made of microscopic particles with a few nanometres-wide cavities in which many substances can be encapsulated. These particles can carry both lipophilic and hydrophilic substances, thereby improving the solubility of poorly water-soluble molecules. The studies conducted in this field prove that the tiny mesh-like structures called nanosponges may revolutionise the treatment of many diseases, and early trials suggest this technology is up to five times more effective at delivering drugs for breast cancer than conventional methods [1]. The nanosponge is about the size of a virus with a 'backbone' (a scaffold structure) of naturally degradable polyester. They 'cross-link' polyester segments to form a spherical shape with many pockets (or cavities) where drugs can be encapsulated. Polyester is biodegradable, which means that when it breaks down in the body, the drug can be released on a known schedule [2].

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Review

Biomedical applications of nanomaterials in the advancement of nucleic acid therapy: Mechanistic challenges, delivery strategies, and therapeutic applications

Krishna Yadav [a], Kantrol Kumar Sahu [b], Sucheta [c], S. Princely Ebenezer Gnanakani [d], Pavani Sure [e], R. Vijayalakshmi [f], V.D. Sundar [g], Versha Sharma [h], Ruchita Antil [i], Megha Jha [j], Sunita Minz [k], Anindya Bagchi [l], Madhulika Pradhan [k,*]

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ARTICLE INFO

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Non-viral vector
Nanomaterial
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ABSTRACT

In the past few decades, substantial advancements has been made in nucleic acid (NA)-based therapies. Promising treatments include mRNA, siRNA, miRNA, and anti-sense DNA for treating various clinical disorders by modifying the expression of DNA or RNA. However, their effectiveness is limited due to their concentrated negative charge, instability, large size, and host barriers, which make widespread application difficult. The effective delivery of these medicines requires safe vectors that are efficient & selective while having non-pathogenic qualities; thus, nanomaterials have become an attractive option with promising possibilities despite some potential setbacks. Nanomaterials possess ideal characteristics, allowing them to be tuned into functional bio-entity capable of targeted delivery. In this review, current breakthroughs in the non-viral strategy of delivering NAs are discussed with the goal of overcoming challenges that would otherwise be encountered by therapeutics. It offers insight into a wide variety of existing NA-based therapeutic modalities and techniques. In addition to this, it provides a rationale for the use of non-viral vectors and a variety of nanomaterials to accomplish efficient gene therapy. Further, it discusses the potential for biomedical application of nanomaterials-based gene therapy in various conditions, such as cancer therapy, tissue engineering, neurological disorders, and infections.

1. Introduction

With the advent of cutting-edge biomedical technology, significant strides have been made in the prevention, diagnosis, and treatment of fatal diseases and conditions, including genetic anomalies [1–3]. However, not all diseases can be treated with pharmacological drugs, biologics, or peptide-based therapies. Typical pharmaceutical methods are ineffective against many genetic illnesses that manifest at birth or later in life [3]. As new therapeutic techniques become available, treatment plans have a better chance of eliminating the root causes as well as the symptoms [4–5].

NA therapy is one of the powerful processes of changing the genetic material of mutated cells to treat or improve patients' health [6]. The therapy delivers therapeutic NA and regulatory elements into the

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Novel Clarithromycin Loaded Self Emulsifying Drug Delivery System for Amplification of Solubility and Oral Bioavailability

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ABSTRACT

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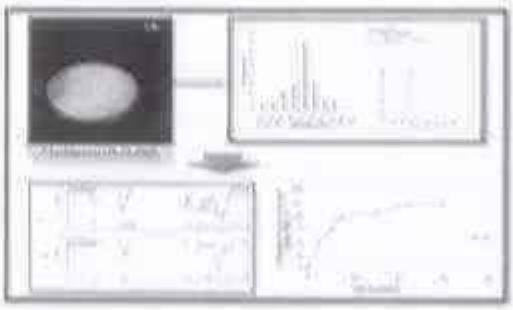

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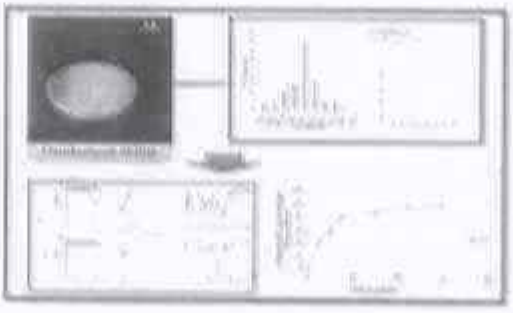

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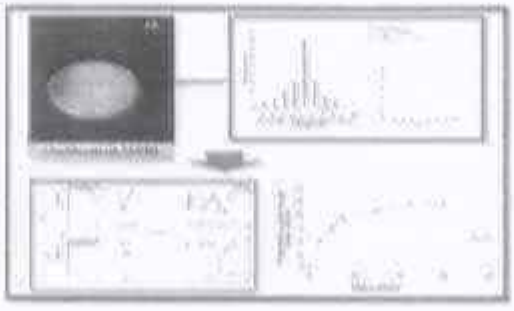

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Section A-Research paper
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FORMULATION AND EVALUATION OF SELF MICROEMULSIFYING DRUG DELIVERY SYSTEM OF CARVEDILOL

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Keywords: Carvidilol, Formulation, Release profiles, Emulsification

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Design, Formulation and optimization of liquisolid compact of Atazanavir by using DoE approach

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ABSTRACT

Because of its limited water solubility, the anti-HIV drug atazanavir requires a unique drug delivery mechanism to improve its therapeutic efficacy and safety. The primary purpose of this study was to develop a method for producing liquisolid powder compacts (LSPCs), which have been shown to be a promising solubility enhancement technique for effective oral administration of BCS class II drugs. Therefore, a unique LSPC formulation of the BCS class II drug atazanavir was developed in an effort to enhance its oral administration. Transcutol HP, propylene glycol, span 20, and span 80 were used in the solubility tests. Transcutol HP was used in the formulation of the LSPCs since it is a non-volatile solvent. In order to measure how various formulation factors affect LSPC performance, a 3^2-factorial design was used. Dependent variables were disintegration time and cumulative drug release percentage; independent variables were the percent of ataznavir in transcutol HP (X1) and the percent of sodium starch glycolate (X2). High dissolving profile with acceptable tablet characteristics were achieved in LSPCs of Atazanavir prepared with propylene glycol at the optimal drug concentration. No drug-polymer interactions were found using Fourier transform infrared spectroscopy (FTIR), and Atazanavir was converted from a crystalline to an amorphous state using differential scanning calorimetry (DSC) and X-ray diffraction (XRD). The potential of LSPCs for increased permeation of Atazanavir over the rat intestinal barrier was also highlighted by permeation tests performed in isolated rat intestine. The better oral administration of Atazanavir shown by the increased penetration of clonazepam from LSPCs formulation through rat gut warrants further investigation.

Keywords: Atazanavir, Fourier transform infra-red spectroscopy, differential scanning calorimetry, liquisolid powder compacts, anti-HIV, 3^2 factorial design, Drug release studies.

INTRODUCTION

The oral route is the most preferred means of drug administration due to the ease, high patient compliance, and low cost of production. The drug must be presented in solution form for absorption through gastrointestinal tract (GIT) when given orally [1,2]. In the case of poorly soluble drugs, dissolution is the rate-limiting step in absorption process. Generally, compounds with aqueous solubility lower than 100 mg/mL show dissolution-limited absorption and erratic and/or incomplete absorption from the gastrointestinal tract of animals and humans. Advancements in the fields of biotechnology and drug discovery have led to the discovery of increasingly large number of active molecules [3]. However, 40% of all newly developed drugs are poorly soluble or insoluble in water, leading to ineffective absorption and therapeutic failure. Various techniques are reported to improve the dissolution of poorly soluble drugs, including solid dispersions, crystal engineering, ball milling, complexation, self-emulsifying drug delivery systems and the use of mesoporous silica carriers [4,5,6]. Recently, the liquisolid technique has shown promise for improved dissolution. The concept of liquisolid tablets was developed from powdered solution technology that can be used to formulate liquid medication. A liquisolid system is defined as dry, non-adherent, free-flowing

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Advances in Bioresearch

ORIGINAL ARTICLE

Gellan Gum-Based Hydrogel for The Transdermal Delivery of Naproxen Sodium: Statistical Optimization and *In-Vitro* Evaluation

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ABSTRACT

Naproxen sodium is a non-steroidal anti-inflammatory drug (NSAID) often used for the symptomatic management of inflammatory conditions such rheumatoid arthritis and ankylosing spondylitis. The present study set out to prepare Naproxen Sodium based hydrogel and optimise it using Box behnken design (BBD). Using different concentrations of gellan gum, carbopol, and polyethylene glycol formulations F1-F17 were made. F9 was chosen and seems to have optimal physicochemical parameters for transdermal administration. After 12 hours, the drug release from the optimised formulation was still above 90%. Rheological measurements confirmed the formulation's viscoelastic behaviour and long-term stability. Carbopol concentration was shown to have a larger effect on gel viscosity than gellan gum concentration. F9 was shown to have a higher rate of drug release compared to other pure drug solutions.

Key words: *Naproxen Sodium, Gellan Gum, Carbopol, Box behnken design, Hydrogel*

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INTRODUCTION

Rheumatoid arthritis (RA) is an inflammatory disease associated with severe pain, stiffness, and peripheral joint swelling [1]. Naproxen is generally used to treat pain, pyrexia, inflammation, and stiffness produced by osteoarthritis, rheumatoid arthritis, injuries, tendinitis, bursitis, and psoriatic arthritis. From the perspective of the side effects related to naproxen's oral route, it can be administered safely via topical drug delivery with minimal side effects [2]. Additionally, the topical approach offers certain distinct advantages: a practically larger surface area of skin for absorption, local drug delivery to affected tissues, a non-invasive route, eliminated side effects, maintenance of plasma-drug concentration, ease of removal or replacement, and the avoidance of presystemic metabolism. Being a BCS class II drug, a suitable drug delivery system which can load an adequate amount of Naproxen and release it on the skin surface is good for its transdermal therapy [3]. Hydrogel, a versatile drug delivery system, has emerged as an attractive delivery mode for transdermal therapy of drugs because of the physicochemical and biological characteristics it possesses, which includes controlled drug release, good stability, higher percutaneous absorption, and nontoxic nature [4]. In addition, hydrogels can offer the advantages of flexibility in dosing, ease of application, reduce skin irritation, promote skin hydration, improve drug diffusion, and improve patient compliance. Among various polymers studied, gellan gum, an anionic polysaccharide, has gained much attention in recent years owing to its excellent gelling and tunable mechanical properties [5].

Optimization was performed by examining the effect of various formulation components (gellan gum, carbopol, and PEG 400) on viscosity, in vitro release, and ex vivo permeation. The optimized gel (F9)

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Advances in Bioresearch

ORIGINAL ARTICLE

Gellan Gum-Based Hydrogel for The Transdermal Delivery of Naproxen Sodium: Statistical Optimization and *In-Vitro* Evaluation

Anilkumar Vadaga[1]*, Vankayala Devendiran Sundar[1], Magharla Dasaratha Dhanaraju[2], Saiparimala Tibirisetty[1]
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ABSTRACT
Naproxen sodium is a non-steroidal anti-inflammatory drug (NSAID) often used for the symptomatic management of inflammatory conditions such rheumatoid arthritis and ankylosing spondylitis. The present study set out to prepare Naproxen Sodium based hydrogel and optimise it using Box behnken design (BBD). Using different concentrations of gellan gum, carbopol, and polyethylene glycol formulations F1-F17 were made. F9 was chosen and seems to have optimal physicochemical parameters for transdermal administration. After 12 hours, the drug release from the optimised formulation was still above 90%. Rheological measurements confirmed the formulation's viscoelastic behaviour and long-term stability. Carbopol concentration was shown to have a larger effect on gel viscosity than gellan gum concentration. F9 was shown to have a higher rate of drug release compared to other pure drug solutions.
***Key words:** Naproxen Sodium, Gellan Gum, Carbopol, Box behnken design, Hydrogel*

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ORIGINAL ARTICLE

Dapagliflozin -Loaded Ethosomes as Transdermal Drug Delivery Carriers: Statistical Design, Formulation And Evaluation

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ABSTRACT

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Transdermal route is, therefore, a better alternative to achieve constant plasma levels for prolonged periods of time, which additionally could be advantageous because of less frequent dosing regimens. The use of lipid vesicles as drug delivery systems for skin treatment has attracted increasing attention in recent years. However, it is generally accepted that conventional liposomes are of little value for this purpose [7,8]. Liposomes remain confined to the upper layer of stratum corneum (SC) and, hence, are suitable for topical drug delivery. Only specially designed vesicles were shown to deliver drugs across the skin layers.

Ethosomes contain phospholipids, alcohol (ethanol and isopropyl alcohol) in relatively high concentration and water. Unlike classical liposomes, ethosomes were shown to permeate through the stratum corneum barrier and were reported to possess significantly higher transdermal flux in comparison to liposomes. Although, the exact mechanism for better permeation into deeper skin layers from ethosomes is still not clear [9,10]. The synergistic effects of the combination of phospholipids and high concentration of ethanol in vesicular formulations have been suggested to be responsible for deeper distribution and penetration in the skin lipid bilayers.

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Advances in Bioresearch

ORIGINAL ARTICLE

Design and Optimization of Self-Micro Emulsifying Drug Delivery Systems for Improved Solubility and Bioavailability of Nebivolol

Magharla Dasaratha Dhanaraju[1]*, Vankayala Devendiran Sundar[1], Anilkumar Vadaga[1], Kurukuri Veera Lakshmi[1].
Research Labs, GIET School of Pharmacy, Rajahmundry, AP, India.
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ABSTRACT

Nebivolol (NB) is a lipophilic molecule with low solubility in GI fluid, and high metabolism which leads to its low oral bioavailability 12%. The aim of the present investigation was to develop Self-micro emulsifying drug delivery systems (SMEDDS) to enhance the solubility and permeability of the drug. Solubility study, pseudo-ternary phase diagram, and 3² factorial design (Box-Behnken design-BBD) were used to select the components of the system and optimize the composition of liquid SMEDDS. Tween 20, Tween 80, Spans as surfactants, Polyethylene glycol (PEG, Propylene Glycol (PG) as surfactants, and Grape Seed Oil (GSE) as oil were all tested for their ability to promote self-micro emulsification. Based on data from the ternary phase diagram, in vitro drug release, droplet size, and zeta potential, formulation 4 (F4) was determined to be the most effective formulation. The improved formulation yielded a microemulsion with a droplet size of around 330 nm and a zeta potential of zero. Iteratively Differentiated Processing. Nebivolol's molecular dissolution in the Solid SMEDDS was validated by calorimetry and powder X-ray diffraction. In vitro drug release tests for the F4 formulation indicated 78.86% and 99.05% drug release at 45 and 120 minutes, respectively. Studies in an ex-vivo setting indicated that the F4 formulation allowed 71.3% of the medicine to penetrate after 120 minutes, whereas the pure drug only allowed 30.75 % to do so. Based on these findings, it seems that SMEDDS may be used to improve the solubility and dissolution of chemicals that are already somewhat poorly soluble, such as Nebivolol.

Keywords: *Nebivolol, SMEDDS, oil, Surfactant, 3² factorial designs, optimization.*

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INTRODUCTION

Nebivolol (NB) is an oral, highly selective third generation β_1-receptor antagonist, having nitric oxide enhancing vasodilator effect, indicated for the treatment of hypertension [1,2]. Also, Nebivolol has reduced typical beta-blocker-related side effects such as fatigue, clinical depression, bradycardia, and impotence [3,4]. After oral administration of NB, the peak pharma concentration reaches within 0.5-2 h. Oral bioavailability of NB is 12% only because of first-pass hepatic metabolism caused by cytochrome P450 2D6 enzymes. It has a suitable log P of 4.03 and the recommended daily dose is 5 mg [5]. The drug is highly lipophilic belonging to the class BCS II, having low dissolution rate and bioavailability [6]. Various efforts have been made to develop effective delivery systems to improve water solubility and bioavailability of NB including preparation of liquid solid compact [8], solid dispersions [9], nanoparticulate delivery [10], oral nanoemulsion [11], orodispersible [12] and immediate release tablets [13].

One potential strategy to improve drug solubility and bioavailability is the use of a self-micro-emulsifying drug delivery system (SMEDDS). An isotropic combination of oil, surfactant, and cosurfactant that, following dilution with an aqueous medium in the GI tract and mild agitation, creates a fine oil-in-water (o/w) microemulsion, thus increasing the interfacial area and the drug's distribution [14]. Oil, surfactant, and cosurfactant are only a few of the ingredients that must be carefully chosen and used in the right amounts if an optimum SMEDDS formulation is to be created. Many methods from experimental design

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ABSTRACT

Nebivolol (NB) is a lipophilic molecule with low solubility in GI fluid, and high metabolism which leads to its low oral bioavailability 12%. The aim of the present investigation was to develop Self-micro emulsifying drug delivery systems (SMEDDS) to enhance the solubility and permeability of the drug. Solubility study, pseudo-ternary phase diagram, and 3² factorial design (Box-Behnken design-BBD) were used to select the components of the system and optimize the composition of liquid SMEDDS. Tween 20, Tween 80, Spans as surfactants, Poly-ethylene glycol (PEG, Propylene Glycol (PG) as surfactants, and Grape Seed Oil (GSO) as oil were all tested for their ability to promote self-micro emulsification. Based on data from the ternary phase diagram, in vitro drug release, droplet size, and zeta potential, formulation F4 [14] was determined to be the most effective formulation. The improved formulation yielded a microemulsion with a droplet size of around 330 nm and a zeta potential of zero. Intuitively Differentiated Processing. Nebivolol's molecular dissolution in the Solid SMEDDS was validated by calorimetry and powder X-ray diffraction. In vitro drug release tests for the F4 formulation indicated 78.86% and 99.05% drug release at 45 and 120 minutes, respectively. Studies in an ex-vivo setting indicated that the F4 formulation allowed 71.3% of the medicine to penetrate after 120 minutes, whereas the pure drug only allowed 30.75 % to do so. Based on these findings, it seems that SMEDDS may be used to improve the solubility and dissolution of chemicals that are already somewhat poorly soluble, such as Nebivolol.

Keywords: *Nebivolol, SMEDDS, oil, Surfactant, 3² factorial design, optimization.*

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INTRODUCTION

Nebivolol (NB) is an oral, highly selective third generation β₁-receptor antagonist having nitric oxide enhancing vasodilator effect, indicated for the treatment of hypertension [1,2]. Also, Nebivolol has reduced typical beta-blocker-related side effects such as fatigue, clinical depression, bradycardia, and impotence [3,4]. After oral administration of NB, the peak plasma concentration reaches within 0.5-2 h. Oral bioavailability of NB is 12% only because of first-pass hepatic metabolism caused by cytochrome P450 2D6 enzymes. It has a suitable log P of 4.63 and the recommended daily dose is 5 mg [5]. The drug is highly lipophilic belonging to the class BCS II, having low dissolution rate and bioavailability [6]. Various efforts have been made to develop effective delivery systems to improve water solubility and bioavailability of NB including preparation of liquid solid compact [7], solid dispersions [9], nanoparticulate delivery [10], oral nanoemulsion [11], orodispersible [12] and immediate release tablets [13].

One potential strategy to improve drug solubility and bioavailability is the use of a self-micro-emulsifying drug delivery system (SMEDDS). An isotropic combination of oil, surfactant, and cosurfactant that, following dilution with an aqueous medium in the GI tract and mild agitation, creates a fine oil-in-water (o/w) microemulsion, thus increasing the interfacial area and the drug's distribution [14]. Oil, surfactant, and cosurfactant are only a few of the ingredients that must be carefully chosen and used in the right amounts if an optimum SMEDDS formulation is to be created. Many methods from experimental design

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Formulation and Evaluation of Lamivudine Niosomes by thin Film Hydration Technique

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KEYWORDS
Niosomes, Ionic-surfactant, Lamivudine

ABSTRACT:
Niosomes are generated from the self-assembly of hydrated amphiphilic surfactant monomers. Various nonionic surfactants belonging to different chemical classes have been found to be useful alternatives to phospholipids in assembling vesicular carriers. The terminology does suggest that distinctions exist between niosomes and liposomes. They may differ in their chemical composition, but have similar physical properties. However, niosomes may also be prepared with ionic amphiphilic like negatively charged dicetylphosphate (DCP) or positively charged stearylamine (SA) in order to achieve a stable vesicular suspension The concept of incorporating the drug into niosomes for a better targeting of the drug at appropriate tissue destination is widely accepted by researchers and academicians. Niosomes represent a promising drug delivery module. They possess a structure similar to liposome and hence they can represent alternative vesicular systems with respect to liposomes, due to the niosome ability to encapsulate different type of drugs within their multi compartmental structure. Niosomes are thought to be better candidates drug delivery as compared to liposomes due to various factors like cost, stability etc. Lamivudine is one of the most effective drug in the treatment of antiretroviral.
The objective of the study is to develop lamivudine niosomes containing in different concentration of surfactant by thin Rotary Evaporator. The Lamivudine Niosomes aim to treat HIV/AIDS; Inhibits the HIV transcriptase enzyme competitively and act as a chain terminator of DNA synthesis were formulated by thin film Hydration Technique using Rotary evaporator.

INTRODUCTION

Controlled drug delivery systems have acquired a center stage in the area of pharmaceutical research and development sector. [1,2] Controlled drug delivery systems, which release the drug in continuous manner by both dissolutions controlled as well as diffusion controlled mechanisms. In recent years it has been shown that the skin a useful route for drug delivery to the systemic circulation. [3-7] Transdermal drug delivery system includes all topically administered drug formulations intended to deliver the active ingredients into the circulation. [8]. They provide controlled continuous delivery of drugs through the

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ORIGINAL ARTICLE **OPEN ACCESS**

Formulation, Characterization and Optimization of Ketoprofen Loaded Hydrogel Films

Magharla Dasaratha Dhanaraju*, Vankayala Devendiran Sundar, Anilkumar Vadaga, Veeranjaneyulu N P.
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ABSTRACT

Hydrogel dressings comprised of hydrophilic, inflated, and soluble components are frequently available in the form of gel and film. They are only appropriate for the exterior of wounds because they merely comprise 70-90% water, which allows them to absorb excessive exudates. They have numerous advantages in drug delivery, bioengineering, sanitation products, farming, waste water treatment, textiles, and packaged food. Hydrogels generated from biodegradable polymers and their analogues have been extensively exploited in medication delivery and bioengineering purposes in recent years. Employing citric acid as a crosslinker, hydroxyethyl cellulose (HEC) hydrogel films were made in the current study for the controlled release of a model hydrophobic medication (Ketoprofen). Crosslinking enhanced the mechanical characteristics and fluid absorption capacity of dressings. Swelling, mechanical and mucoadhesive properties of blank and drug-loaded films were evaluated and compared. Drug loaded films showed better swelling and mucoadhesive profile. It can therefore be inferred that citric acid could be employed to create HEC hydrogel films. Altogether, the findings suggest that HEC hydrogel films are ideal for improved drug-loading and controlled release of weakly soluble medicines. The outcomes strongly suggest that hydrogel films can be utilized as possible wound healing materials.

Keywords: *Wound healing, wound dressings, hydrogels, hydroxyethyl cellulose, citric acid, Ketoprofen, swelling property, tensile strength, adhesion*

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INTRODUCTION

Wound healing is a complex and dynamic biological process that involves haemostasis/inflammation, cell proliferation, and tissue remodelling phases [1]. Wound dressings of various shapes, sizes, colours, and origins have been developed to create and maintain a moist environment, as well as to provide optimal conditions for wound healing [2]. The use of biopolymer-based hydrogels as wound dressings is popular owing to their biocompatibility and biodegradability. Despite recognized benefits, the use of hydrogels is still associated with some challenges because of a few limitations. These include mechanical weakness, water sensitivity, and instability under physiological conditions, with unpredictable behaviour in long-term applications [3].

Hydrogel dressings are most often accessible in gel and film forms and are totally fabricated of hydrophilic, expandable, and biodegradable constituents. Since they contain only 70-90% moisture, they should only be applied to top of wounds to soak up superfluous exude. Hydrogels generated from biodegradable polymers and their analogues have been extensively exploited in medication delivery and bioengineering purposes in recent years [4,5]. Addition of crosslinkers to hydrogels is one approach to improve the physical properties and stability of hydrogels via impeding the dissolution and disintegration of the polymer matrix. The selection of crosslinkers is important to avoid toxicity and undesirable reactions with the hydrogel polymer matrix [6]. However, they are useful, especially for the encapsulation of labile bioactive substances and living cells in hydrogels. Employing citric acid as a crosslinker, hydroxyethyl cellulose (HEC) hydrogel films were made in the current study for the controlled release of a ketoprofen [7].

MATERIAL AND METHODS

Ketoprofen drug was purchased from BEC Chemicals, Mumbai, India. 2-Hydroxyethyl cellulose, citric acid, β- Cyclodextrin was purchased from Sigma-Aldrich.

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Design and Characterization of Lamivudine Niosomal Drug Delivery System

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ABSTRACT
The purpose of this research was to formulate Lamivudine Niosome drug delivery system by thin film hydration technique using non-ionic surfactants (Span 40) in different ratio. Optimization of formulation variables are done by Statistical design. Three independent variables such as Span, RPM, Sonication time, and three dependent variables such as particle size, EE%, drug release %. Total of 15 formulations were run at three level design. FT-IR spectra of pure drug and its polymer used in formulations indicate that there were no structural changes caused by excipients. Using scanning electron microscopy, the synthesised niosomes were examined microscopically to determined. Microscopically, F-I, F-II, and F-III were identified as spherical tiny unilamellar vesicles with diameters of 150–430 nm, 150–250 nm, and 250–280 nm, respectively. The percentage of drug entrapment in F I, which included span 40(30mg), was found to be 76.61%, whereas that of F-II and F-III, which contained span 40(25mg) and span 40(20mg), was found to be 66.42% and 58.59%, respectively. Particle size analyzer was used to characterise the size distribution of niosomes. For F-I, F-II, and F-III, respectively, the typical mean particle size range was 120 nm, 205 nm, and 265 nm. In-vitro release studies of F-I indicated a 19-hour drug release of 93.48%. In contrast to F-III, which exhibited an 84.99% drug release within 19 hours, F-II demonstrated an 87.97% drug release within 20 hours. Additionally, F-I containing span 40(30mg) demonstrated higher release compared to F-II and F-III containing span 40(25mg) and 20mg, respectively. Niosomal Lamivudine tubes were clear, indicating that they are sterile. The formulated niosomes passed the Sterility test.
Keywords: *Niosomes, Lamivudine, Non-ionic surfactants, Drug release, Sterility test.*

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Niosomes are non-ionic surfactant vesicles, capable of forming vesicles & entrapping hydrophilic and hydrophobic molecule.[2] Niosomes possess an infrastructure consisting of hydrophilic and hydrophobic moieties together, and as a result, can accommodate drug molecules with a wide range of solubilities. Non-ionic surfactants are comprised of polar and non- polar segments and possess high interfacial activity [3,4]. The formation of bilayer vesicles instead of micelles is dependent on the hydrophilic-lipophilic balance (HLB) of the surfactant. They have longer shelf life, stability and ability to deliver the drug at the target site in a controlled or sustained manner which enhances bioavailability and they offer several advantages over liposomes such as higher chemical stability, lower costs and ability to deliver the drug at the target site in a controlled or sustained manner which enhances bioavailability [5,6].

MATERIAL AND METHODS

Materials

Lamivudine was obtained as a gift sample from Micro Labs, Hosur. Span 40 and cholesterol, Chloroform were purchased from SD fine chemicals ltd. (Mumbai, India).

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ABSTRACT

The purpose of this research was to formulate Lamivudine Niosome drug delivery system by thin film hydration technique using non-ionic surfactants (Span 40) in different ratio. Optimization of formulation variables are done by Statistical design. Three independent variables such as Span, RPM, Sonication time; and three dependent variables such as particle size, EE%, drug release %. Total of 15 formulations were run at three level design. FT-IR spectra of pure drug and its polymer used in formulations indicate that there were no structural changes caused by excipients. Using scanning electron microscopy, the synthesized niosomes were examined microscopically to determined. Microscopically, F-I, F-II, and F-III were identified as spherical tiny unilamellar vesicles with diameters of 110–130 nm, 150–260 nm, and 250–280 nm, respectively. The percentage of drug entrapment in F-I, which included span 40(30mg), was found to be 76.61%, whereas that of F-II and F-III, which contained span 40(25mg) and span 40(20mg), was found to be 66.42% and 58.53%, respectively. Particle size analyzer was used to characterise the size distribution of niosomes. For F-I, F-II, and F-III, respectively, the typical mean particle size range was 120 nm, 205 nm, and 265 nm. In-vitro release studies of F-I indicated a 19-hour drug release of 93.48%. In contrast to F-III, which exhibited an 84.99% drug release within 19 hours, F-II demonstrated an 87.92% drug release within 20 hours. Additionally, F-I containing span 40(30mg) demonstrated higher release compared to F-II and F-III containing span 40(25mg) and 20mg, respectively. Niosomal Lamivudine tubes were clear, indicating that they are sterile. The formulated niosomes passed the Sterility test.

Keywords: *Niosomes, Lamivudine, Non-ionic surfactants, Drug release, Sterility test.*

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INTRODUCTION

Controlled drug delivery systems have acquired a centre stage in the area of pharmaceutical research and development sector. Controlled drug delivery systems, which release the drug in continuous manner by both dissolution-controlled as well as diffusion-controlled mechanisms [1].

In recent years it has been shown that the skin a useful route for drug delivery to the systemic circulation. Transdermal drug delivery system includes all topically administered drug formulations intended to deliver the active ingredients into the circulation. They provide controlled continuous delivery of drugs through the skin to the systemic circulation.

Niosomes are non-ionic surfactant vesicles, capable of forming vesicles & entrapping hydrophilic and hydrophobic molecule.[2] Niosomes possess an infrastructure consisting of hydrophilic and hydrophobic moieties together, and as a result, can accommodate drug molecules with a wide range of solubilities. Non-ionic surfactants are comprised of polar and non- polar segments and possess high interfacial activity [3,4]. The formation of bilayer vesicles instead of micelles is dependent on the hydrophilic-lipophile balance (HLB) of the surfactant. They have longer shelf life, stability and ability to deliver the drug at the target site in a controlled or sustained manner which enhances bioavailability and they offer several advantages over liposomes such as higher chemical stability, lower costs and ability to deliver the drug at the target site in a controlled or sustained manner which enhances bioavailability [5,6].

MATERIAL AND METHODS

Materials

Lamivudine was obtained as a gift sample from Micro Labs, Hosur. Span 40 and cholesterol, Chloroform were purchased from SD fine chemicals ltd, (Mumbai, India).

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Design and Characterization of Lamivudine Niosomal Drug Delivery System

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ABSTRACT

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Vankayala Devendiran Sundar*, Magharla Dasaratha Dhanaraju, Anilkumar Vadaga, Chaitanya Arigela
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ABSTRACT

The aim of the present investigation was the development and evaluation of Famotidine oral insitu gel to treat upper gastro intestinal ulcers. In the present work, a three-factor at three-level Box-Behnken design was adopted to inspect the effects of three factors viz. sodium alginate [A], sodium bicarbonate [B], and sodium citrate [C] on the dependent variables like in vitro gelation, in vitro floating, percentage water uptake, and percentage drug release. The Box-Behnken model suggests that the development of a famotidine oral in situ gelling device was a complete success. The optimized in situ gel floated and gelled as desired, releasing a sufficient dose of medication into the stomach. pH values for all the preparations have been between 6.34 and 7.15, within a margin of error of 0.19 and 0.13. With immediate invitro gelation, the drug concentration was found to be between 96.31±0.18 and 99.02±0.14%, and it remained stable for a long time. There was an observed range of 7.36±0.2s to 29.41±0.24% in terms of water intake, and an estimated range of 8.95±0.2s to 56.35±0.34s in terms of floating lag time. All formulations had released over 98% of the medication during the 8-h time frame, with F1 and F2 showing floating even after 12 h. The impact of the chosen independent variables on the dependent ones were found to be quite large. Responses such floating lag time, percentage water absorption, and % drug release at 12 h and 24 h have shown significant changes in response to slight changes in concentrations of components A, B, and C. Results suggest that oral floating in situ gel formulated with Famotidine tartrate promotes sustained medication release.

Keywords: *Famotidine, NSAIDs, oral In Situ gel, H2-receptor antagonist, Box-Behnken design, Drug release studies*

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INTRODUCTION

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The formation of a gastroretentive in situ gelling device has sparked increased interest in both academics and business. This is mostly attributable to the in-situ gelling system's significant benefits, which include ease of administration and decreased administration frequency and hence aid to improve patient compliance [3]. Controlled medication delivery with improved gastroretention can be achieved via gastroretentive in situ gelling devices, also referred to as stomach specific systems. When in contact with bodily fluids or when the pH changes, in situ gelling systems, which are liquid at room temperature, begin to gel [4]. Due to the bioadhesive nature of the polymer and the fact that the gel produced by the in situ gelling system is lighter than gastric fluids, it floats over the stomach contents or sticks to the gastric mucosa, producing gastric retention of the dosage form and increasing gastric residence time, which prolongs the time that the drug is delivered to the gastrointestinal tract [5]. The system uses polymers that go through a sol-gel phase transition as a result of modifications in particular physicochemical characteristics.

A histamine H2-receptor antagonist is Famotidine. Local administration of Famotidine improves the drug's bioavailability at the receptor site on the stomach wall and boosts its effectiveness in lowering acid secretion [6]. In order to distribute drug in the stomach for extended periods of time, the current work set out to generate and evaluate a floating in situ gelling system containing Famotidine.

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Advances in Bioresearch

ORIGINAL ARTICLE

Formulation Development and *In vitro* Evaluation of Lovastatin Nanosponges by Emulsion Solvent Evaporation Method

Magharla Dasaratha Dhanaraju[1]*, Vankayala Devendiran Sundar[2], Anilkumar Vadaga[3], Yanamadala Meera Anitha[4]

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ABSTRACT

The present investigation was undertaken to prepare nanosponges of Lovastatin to achieve improved drug release. Eudragit RS100, Polyvinyl alcohol (PVA) was used as a polymer, Acetone was used as the solvent. Prepared nanosponges were evaluated for particle size, zeta potential, entrapment efficiency and in vitro drug release. Optical microscopy was used to determine the particle size of the nanosponge, and it was observed that the nanosponges were uniform in size. The average particle size of all formulations ranges from 312.2 nm to 420.2 nm. The entrapment efficiency of formulation F1 was found to be 79.12%, formulation F2 was found to be 82.48%, formulation F3 was found to be 80.54%, formulation F4 was found to be 85.16%, formulation F5 was found to be 78.02%, and formulation F6 was found to be 79.24%, formulation F7 was found to be 73.84%, formulation F8 was found to be 72.88%, and F9 was found to be 72.12 %. F8 shows a high entrapment efficiency of 95.16 % among all the formulations. Hence, Lovastatin loading into nanosponges using the emulsion solvent evaporation process thus successfully boosted and controlled the drug release.

Keywords: *Lovastatin, Nanosponges, Polyvinyl alcohol, Acetone, Eudragit RS100*

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INTRODUCTION

Nanosponges are made of microscopic particles with a few nanometres-wide cavities in which a large variety of substances can be encapsulated. These particles can carry both lipophilic and hydrophilic substances, thereby improving the solubility of poorly water-soluble molecules. The studies conducted in this field prove that the tiny mesh-like structures called nanosponges may revolutionise the treatment of many diseases, and early trials suggest this technology is up to five times more effective at delivering drugs for breast cancer than conventional methods [1]. The nanosponge is about the size of a virus with a 'backbone' (a scaffold structure) of naturally degradable polyester. They 'cross-link' polyester segments to form a spherical shape with many pockets (or cavities) where drugs can be encapsulated. Polyester is biodegradable, which means that when it breaks down in the body, the drug can be released on a known schedule [2].

Lovastatin is a statin medication used primarily to lower cholesterol levels and prevent cardiovascular disease. It operates by inhibiting the enzyme HMG-CoA reductase, which is a key enzyme in the biosynthesis of cholesterol in the liver. This inhibition leads to reduced levels of cholesterol within the body, particularly low-density lipoprotein (LDL) cholesterol, often referred to as "bad" cholesterol due to its association with an increased risk of cardiovascular events. [3,4]

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Magharla D D, Vankayala D S, Anilkumar V, Yanamadala M A. Formulation Development and *In vitro* Evaluation of Lovastatin Nanosponges by Emulsion Solvent Evaporation Method. Adv. Biores. Vol 15 [4] July 2024: 38-49

INTRODUCTION

Nanosponges are made of microscopic particles with a few nanometres-wide cavities in which a large variety of substances can be encapsulated. These particles can carry both lipophilic and hydrophilic substances, thereby improving the solubility of poorly water-soluble molecules. The studies conducted in this field prove that the tiny mesh-like structures called nanosponges may revolutionise the treatment of many diseases, and early trials suggest this technology is up to five times more effective at delivering drugs for breast cancer than conventional methods [1]. The nanosponge is about the size of a virus with a 'backbone' (a scaffold structure) of naturally degradable polyester. They 'cross-link' polyester segments to form a spherical shape with many pockets (or cavities) where drugs can be encapsulated. Polyester is biodegradable, which means that when it breaks down in the body, the drug can be released on a known schedule [2].

Lovastatin is a statin medication used primarily to lower cholesterol levels and prevent cardiovascular disease. It operates by inhibiting the enzyme HMG-CoA reductase, which is a key enzyme in the biosynthesis of cholesterol in the liver. This inhibition leads to reduced levels of cholesterol within the body, particularly low-density lipoprotein (LDL) cholesterol, often referred to as "bad" cholesterol due to its association with an increased risk of cardiovascular events. [3,4]

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FORMULATION DEVELOPMENT AND EVALUATION OPULSATILE DRUG DELIVERY SYSTEM OF HYDROCHLOROTHIAZIDE

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Abstract:

The study aimed to develop and evaluate a pulsatile drug delivery system (PDDS) for hydrochlorothiazide, a thiazide diuretic commonly used for managing hypertension and edema. The PDDS was designed to synchronize drug release with the body's circadian rhythm, targeting early morning peaks in blood pressure. Using the wet granulation method, core tablets were formulated using various super disintegrants (Lycoat, Sodium starch glycolate, and Ludiflash). These tablets were then coated with natural and synthetic polymers, including Xanthan gum, Karaya gum, HPMC K4M, and HPMC K15M, to control the release profile. The formulations were evaluated for pre- and post-compression parameters, drug content uniformity, in vitro drug release, and dissolution kinetics. The optimized core tablet formulation (F9) and coated tablet formulation (CF9) were identified based on their ability to maintain a lag phase followed by a burst release at the desired time, which was confirmed by release kinetics analysis indicating a first-order release mechanism and super case II transport. The study concludes that the PDDS developed for hydrochlorothiazide can effectively provide a time-dependent release profile, making it suitable for chronotherapy in hypertension management.

Keywords: Pulsatile drug delivery system, hydrochlorothiazide, Chronotherapy, Wet granulation, Super disintegrants, Xanthan gum, Karaya gum, HPMC, In vitro release, Dissolution kinetics.

Introduction

Pulsatile drug delivery systems (PDDS) are advanced pharmaceutical technologies designed to release drugs in a time-controlled manner, aligning with the body's circadian rhythms or specific pathophysiological needs, thus enhancing therapeutic efficacy and reducing side effects. These systems are particularly beneficial for diseases that follow predictable patterns, such as asthma, arthritis, and cardiovascular disorders, where drug release is timed to

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