

A Review on Novel Properties of Aceclofenac as Treatment of Pain and Heal Skin Injury for Diabetic Persons

Dushyant Patel^{1*}, Devid Patel^{2*}, Vibha Pal², Anushka Sahu¹, Abhishek Yadav², Narayan¹, Mayur Hirve¹, Roshni Sahu¹, Palak Jain¹

Ms. Shobha Sahu¹, , Dr. Gyanesh Kumar Sahu¹

¹*Rungta Institute of Pharmaceutical Sciences and Reseach,*

²*Rungta Institute of Pharmaceutical Sciences, Kohka Kurud, Bhilai*

Date of Submission: 23-04-2026

Date of Acceptance: 03-05-2026

Abstract:-

It is phenyl acetic acid derivative developed as anti-inflammatory agent. It has analgesic anti-inflammatory antipyretic and skin healing like actions like other NSAIDs. It is recommended in long term treatment of rheumatoid arthritis and Diabetes Mellitus, osteoarthritis and enclosing spondylitis. It is also useful acute miscue skeletal disorder post operative pain and dysmenorrhea. Aceclofenac pain relieving and skin healing combined gel was developed in different formulation methods. By employing different grades of polymers such as HPMC, Carbopol 934 etc. There are various Aceclofenac preparation are present in market. But this type of gels not gave any results for the diabetic patient. The formulation were evaluated for various physical parameters, pH, spreadability, skin irritation, drug release excludability studies drug release mechanisms. This gel shows maximum drug release of 8 hours and maximum drug. The purpose of this study is to prepare the combination of Aceclofenac pain relieving and skin healing gel for Diabetic Persons. This is a combined form of gel that provide rapid onset of action for both effect like analgesic and skin healing. And that is to get instant relieve for pain as comparison of plain aceclofenac and diclofenac tablet or gel. This formulation is much beneficial for the diabetic patent due to using vitamin C and turmeric to get cure fast of skin injury and buildup of skin growth or new epidermis layer of skin in the body. Out of various semisolid dosage forms, gels are becoming more popular dure to ease of application and better percutaneous absorption.

Keywords:- Combined Gel, Aceclofenac, Vitamin C, Turmeric, Analgesic, Skin healing etc.

I. Introduction:-

Topical delivery can be defined as the application of a drug containing formulation to the skin to directly treat cutaneous disorders or the

cutaneous manifestations of a general disease with the intent of containing the pharmacological or other effect of the drug to the surface of the skin. Semi-solid formulation in all their diversity dominates the system for topical delivery. There have been concerns related to the conventional topical dosage forms such as lotions, creams ointment and powder in terms of drug diffusion or release form the vehicle and delivery through the skin. Creams and lotions often provide poor bioavailability of the drug because they are rapidly cleared from the skin and poorly release the drug from the base. Non-hydrophilic ointments are oleaginous, greasy and are not convenient to patients, and also medicated powders for topical application have short residence time on the skin. (1)

Gels are semisolid systems in which the movement of the dispersion medium is restricted by interacting 3dimensional network of particles or solvated macromolecules of dispersed phase. The transdermal drug delivery system are self contained discrete dosage forms which when applied to intact skin deliver the drug through the skin at a controlled rate to the systemic circulation. At present the most common form of delivery of drugs is the oral route molecule. The stratum corneum provides the greatest resistance to penetration and it is the rate. The increased viscosity caused by interlacing and consequential internal friction is responsible for the semisolid state. Also, a gel may consist of twisted matted strands often tied together by stronger types of Vander Waals Forces to form crystalline and amorphous regions throughout the system.

Nano-emulgel is an emerging delivery system intended to enhance the therapeutic profile of lipophilic drugs. Lipophilic formulations have a variety of limitations, which includes poor solubility, unpredictable absorption, and low oral bioavailability. The novel system prepared by the incorporation of nano-emulsion into gel improves stability and enables drug delivery for both

immediate and controlled release. The focus on nano-emulgel has also increase due to its ability to achieve targeted delivery, ease of application, absence of gastrointestinal degradation or the first pass metabolism, and safety profile. (8)

Pain:-

Pain is a distressing feeling often caused by intense or damaging stimuli. The international association for the study of pain defines pain as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage. (2)



Figure 1- Pain

Skin Injury in Diabetic Patient:-

Diabetes can cause changes in the small blood vessels. These changes can cause skin problems called diabetic dermopathy. Dermopathy often looks like light brown, scaly patches. These patches may be oval or circular. Diabetes can also cause wounds to heal more slowly, increasing the risk of infections and other severe complications.(10)



Figure 2- Skin injury in diabetes

1. Drug Profile:-

Acceclofenac:-

Acceclofenac is a nonsteroidal anti-inflammatory drug (NSAID) analog of diclofenac. It is used for the relief of pain and inflammation in rheumatoid arthritis, osteoarthritis and ankylosing spondylitis. It was patented in 1983 and approved for medical use in 1992. Acceclofenac is a crystalline powder with a molecular weight of 354.19. It is practically insoluble in water with good permeability. It is metabolized in human hepatocytes and human microsomes to form acetoxyacetic acid as the major metabolite, which is then further conjugated.

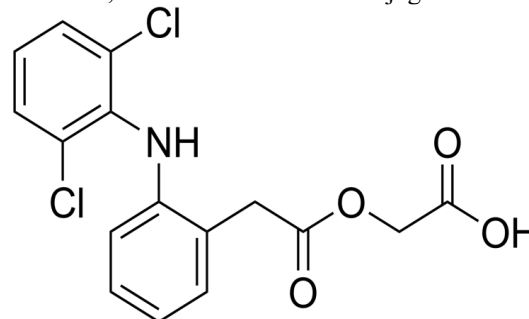


Figure 3- Structure of Acceclofenac

According to the Biopharmaceutical Classification System (BCS) drug substances are classified to four classes upon their solubility and permeability. Acceclofenac works by inhibiting the action of cyclooxygenase that is involved in the production of prostaglandins which is accountable for pain, swelling inflammation and fever.(1)

Ascorbic acid:-

Vitamin C also known as ascorbic acid and ascorbate is a water-soluble vitamin found in citrus and other fruits, berries and vegetables. It is also a generic prescription medication and some countries is sold as a non-prescription dietary supplement. As a therapy, it is used to prevent and treat scurvy, a disease caused by vitamin C deficiency.

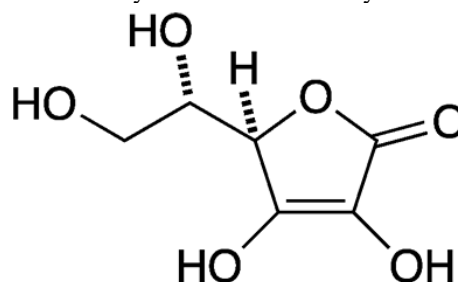


Figure 4- Structure of Ascorbic acid

Vitamin C is an essential nutrient involved in the repair of tissue, the formation of collagen, and the enzymatic production of certain neurotransmitters. It is required for the functioning of several enzymes and is important for immune system function. It is also functions as an antioxidant. Vitamin C may be taken by mouth or by intramuscular, subcutaneous or intravenous injection.

Materials & Methods:-Preformulation Studies:-

The API and other ingredients that should be used for the formulation is collected as per specification and well tested in laboratories.

3. Ingredient Table

S. No.	Name of Ingredients	Functions
1.	Aceclofenac	Pain reliever
2.	Ascorbic acid	Skin healer
3.	Carbopol 934	Polymer
4.	HPMC K4M	Emulsifier
5.	Sodium CMC	Binder
6.	Triethanolamine	PH Stabilizer and Emulsifier
7.	Ethanol	Solvent
8.	Propylene glycol	Moisturizer
9.	Propyl Paraben	Preservative
10.	Distilled Water	Vehicle
11.	Menthol	Fragrance

4. Preformulation Studies:-

• Characterization of Aceclofenac: Description the sample of aceclofenac was analyzed for nature, color and type of organoleptic properties of the drug and its taste.

• Melting point: The melting point was determined by using thiesel's tube apparatus method. Drug excipient were very complex to did its formality and its compatibility studies.

• The drug polymer and polymer- polymer interaction was studied by the FTIR spectrometer using Shimadzu 8400-S. Two percent of the sample with respect to a potassium bromide disc was properly allowing the formulation and at last mixed with dry KBr.

The mixture was grind into a fine powder using an agate mortar and then compressed into a KBr disc in a hydraulic press at a pressure of 1000psi. Each KBr disc was scanned 16 times at 2mm/sec at a resolution of 4cm-1 using cosine apodization. The characteristic peaks were recorded.(5)

5. Procedure:-

• Various batches of gels were prepared with the help of different ethanol and water proportions taken as vehicle in Carbopol 934 base, HPMC K4M out of this formulation batch. All the formulation were evaluated for the post formulation Organoleptic characteristic, homogeneity, drug content, pH, viscosity, spreadability, In vitro diffusion and stability study. It was found that all the formulation were smooth in touch and showed no clogging which indicate good texture of formulation. All the formulation were evaluated spectrophotometrically for the drug content, the results were found in the acceptable range, indicating the no drug and excipient interaction and also form the uniformity of content. It was found that the pH of all the formulation is the range of 6.84 to 7.41 that suits the skin pH, indicating skin compatibility. This is the primary requirement for a good topical formulation.(8)



Figure 5- Prepared Nano-emulgel

6. Evaluation test of Formulation:-

- Homogeneity
- Appearance
- Acid value
- pH Measurement
- Irritancy test
- Viscosity
- Accelerated stability testing
- Subjective properties
- Spreadability
- Type of Emulsion test
- Washability test
- In vitro permeation studies
- Statistical analysis
- Preference test
- Test for thermal stability

- Patch test
- Analgesic activity
- Skin healing activity

7. Pathophysiology of Drug:-

1. COX Inhibition: Aceclofenac primarily blocks cyclooxygenase (COX) enzymes, particularly COX-2, which are crucial for synthesizing inflammatory mediators like prostaglandins from arachidonic acid.
2. Reduced Inflammatory Mediators: By inhibiting COX, it reduces levels of prostaglandins (causing pain/swelling), Interleukin-1 β (IL-1 β), and Tumor Necrosis Factor-alpha (TNF- α).
3. Chondroprotective Effects: A metabolite, 4'-hydroxyaceclofenac, stimulates glycosaminoglycan (GAG) synthesis in cartilage and inhibits cartilage-degrading enzymes (metalloproteinases), protecting joint tissues.
4. Reduced Nitric Oxide & Adhesion: It lowers nitric oxide production in chondrocytes and reduces neutrophil adhesion to blood vessel linings (endothelium) by decreasing L-selectin expression, further dampening inflammation.

8. Result and Discussion:-

The objective of the present study was to formulate Aceclofenac pain relieving and skin healing nanoemul gel. This pain relieving and skin healing gel with different polymer ratios were prepared. In order to select the optimized formulation, various evaluation parameters were checked and subjected to in-vitro diffusion study and their release kinetic study were observed. The project was undertaken with the aim to design nanoemul gel formulation for topical delivery of aceclofenac pain relieving and skin healing nanoemul gel. Preliminary studies indicates that Carbopol 934, and HPMC, can be used as a gelling agents and ethanol as a solvent. Different formulation were screened at preliminary level on the basis of drug solubility, drug release, spreadability, excreatability, rheological behavior etc. The formulation have satisfactory spreadability, rheological behavior and their diffusion profile was comparable to marketed gel formulation.

Table 2 Evaluation Parameter and their result:-

S. no.	Parameter	Result
1.	Ph	6.84-7.41
2.	PKa	4.15
3.	Viscosity	3045.31
4	Spreadability	23.05
5.	Physical Appearance	Clear
6.	Skin irritation	No irritation
7.	Melting Point	275-277
8.	Solubility	Water
9.	Washability	Easily washable

9. Conclusions:-

It was observed that aceclofenac pain relieving and skin healing nanoemul gel in 1:2 ratio (produced better spreadability and consistency as compared to other formulations. The developed gel showed good homogeneity, suitable pH, no skin irritation and good stability. The maximum percentage of drug release was found to be 98.68% in 6 hours in formulation. The drug permeation from optimized formulation i.e. this was slow and steady and 0.89 gm of aceclofenac could permeated through rat abdominal skin membrane with a flux 0.071 gm hr⁻¹ cm⁻² and could possibly permeate through human abdominal membrane. The Carbopol 934P forms water washable gel because of its water solubility and has wider prospects to be used as a topical drug delivery system. Formulation batch (2% Diclofenac, Aceclofenac 10% PG, 0.15% Methylparaben, 0.05% PropylParaben, 1.5% Carbopol 940, 67.44% ethanol, 16.86% water) had shown higher amount of percent cumulative release as compared to marketed gel. Spreadability of formulation was good to cover the painful area. In formulation the ethanol in following concentration had shown the higher penetration enhancer activity which result in higher drug release, flux and permeability value. On the basis of organoleptic characteristic the improved patient acceptability was achieved through formulation. The improved patient convenience might thus be obtained by the administration of such a dosage form with minimal blood level fluctuations. The release penetration enhancer and other materials are cheap, readily available, safe, having wide regulatory acceptance and easy to handle for economic point of view. It may beneficial to adopt such simple technology for the commercial production of Diclofenac Aceclofenac pain relieving gel(1). The future scope of this study is that formulation should be subjected

for long-terms stability and in-vivo performance study.

References:-

- [1]. Prabhat Ekka, Nisha Dewangan , Devid Patel, Kamlesh Kushwaha, Chandrashekhar Sao, Rishabh Yadav and Girdhar Prasad Chakradhari World Journal of Biology Pharmacy and Health Sciences, 2024, 18(02), 227–238
- [2]. Priya P. Munshi, D.S. Mohale, R. Akkalwar, A.V. Chandewar. Formulation and Evaluation of Diclofenac gel. Research J. Pharm. and Tech. 4(9): Sept. 2011; Page 1394- 1399.
- [3]. Kartin Moser, Katrin Kriwet, Aarti Naik, Yogeshwar N.Kalia, Richard H.Guy 2001, "Passive skin penetration enhancement and its qualification in vitro" European Journal of Pharmaceutics and Biopharmaceutics 52, 103- 112.
- [4]. Kumar, R., Katare O. P., 2005. Lecithin organogel as a potential phospholipid-structured system for topical drug delivery: A review, AAPS PharmSciTech. 40, 6 (2), E298-E310.
- [5]. Flynn, L. G., 1996. Cutaneous and Transdermal Delivery: Processes and systems of delivery. In: G. S., Banker, C.T., Rhodes, (Ed.), Modern Pharmaceutics, 3rd edition. Marcel Dekker Inc. New York, 239-298.
- [6]. Indian Pharmacopoeia 2007; "Government of India ministry of health and family welfare, volume 2, Issu2, 1020- 1021.
- [7]. Garg Alka, Aggarwal Deepika, Garg Sanjay, and Singla Anil K. ,SEP-2002, "Spreading of Semisolid Formulation update", Pharmaceutical Technology,(www.Pharmtech.com), 84-102.
- [8]. Magdy I. Mohamed, 2004 "Optimization of Chlorphenesin Emulgel Formulation", The AAPS Journal 6 (3) Article 26, 1-7.
- [9]. Indian Pharmacopoeia, 1996. Volume II, Appendix 13.2, Controller of publications, Ministry of Health and Welfare, Govt. of India, Delhi, A-1.
- [10]. Shrikhande B. K., and Goupale D. C.: Development and evaluation of anti-inflammatory oleogels of Bosewella serrata (gugul) and Curcuma longa (turmeric), Indian Drugs, 2001, 38 (12), 613 – 616.
- [11]. Indian pharmacopoeia 2007. Volume II, Appendix , Controller of publications, Ministry of Health and Welfare, Govt. of India, Delhi, A- ,1021
- [12]. Bidkar sanjay, jaindevendra, padsalgamol, patelkishna and mokalevinod, April Jun 2007, "Formulation development and evaluation of fluconazole in various polymer Based formulation development evaluation of fluconazole gel in various polymer bases," Asian journal of pharmaceutics, volume 1, issue 1, 63-68
- [13]. Hsieh D., Drug Permeation Enhancement-Theory and Applications. In Drug and the Pharmaceutical Sciences, New York, Marcel Dekker, 1987; 11-13
- [14]. Langer R., Transdermal Drug Delivery: Past progress, current status and future prospects. Adv Drug Deliv Rev. 2004; 56: 557-558.
- [15]. Barry B., Transdermal Drug Delivery. In: Aulton ME, Pharmaceutics. The science of dosage form design. 2nd ed. Churchill, Livingstone, 2002; 499-543.
- [16]. Idson B., Jack L., Semisolids. In: Lachmann L, Liebermann HA and Kanig JL. The Theory and Practice of Industrial Pharmacy, 3rd ed. Bombay: Varghese Publishing House, 1990; 534-563.
- [17]. Pena LE., Gel dosage form: Theory, Formulation and Processing. In: Osborne DW, Amann AH. Topical drug delivery formulation. New York, Marcel Dekker; 1990; 381- 388.
- [18]. Alberto B., Clinical pharmacokinetics and metabolism of Nimesulide in flammopharmacology. 2001; 9: 81-89.
- [19]. Sankar S V., Chandrasekharan AK., Durga S., Prasanth KG., Nilani P., Formulation and stability evaluation of diclofenac sodium ophthalmic gels. Ind. J. Pharm. Sci. 2005; 67(4): 473-476.
- [20]. Lakshmi P K., Marka K K., Aishwarya S., Shyamala B., Formulation and evaluation of Ibuprofen Topical gel: A Novel approach for penetration enhancement. Int. J. Applied Pharm. 2011; 3 (3): 25-30.
- [21]. Swamy N.G.N., Mazhar P., Zaheer A., Formulation and evaluation of Diclofenac sodium gels using Sodium carboxymethyl Hydroxypropyl Guar and Hydroxypropyl methylcellulose. Indian J. Pharm. Educ. Res. 2010; 44 (4): 310-314.
- [22]. P.B.Patil, S.K.Datir, R.B.Saudagar. Journal Of Drug Delivery And Therapeutics. 2019; 9 (3-S), 989-994.

- [23]. Poonam Madhukar Kasar, Kalyanisundarrao Kale, Dipti Ganesh Phadtare International Journal Of Current pharmaceutical Research-2018 ;10(4),71-74.
- [24]. Mayer FL, Wilson D, Hube B. *Candida albicans* pathogenicity mechanisms. Virulence. 2013; 15; 4(2):119-28. <https://doi.org/10.4161/viru.22913>
- [25]. Berman J. *Candida albicans*. Current biology. 2012; 21;22(16):R620-2. <https://doi.org/10.1016/j.cub.2012.05.043>
- [26]. Kuhbacher A, Henkel H, Stevens P, Grumaz C, Finkelmeier D, BurgerKentischer A, Sohn K, Rupp S. Dermal fibroblasts play a central role in skin model protection against *C. albicans* invasion. J. Infect. Dis. 2017. <https://doi.org/10.1093/infdis/jix153>
- [27]. Nayak D, Tawale RM, Aranjani JM, Tippavajhala VK. Formulation, optimization, and evaluation of novel ultra-deformable vesicular drug delivery system for an anti-fungal drug. American Association of Pharmaceutical Association, 2020; 21(5):1-0. <https://doi.org/10.1208/s12249-020-01681-5>
- [28]. Chapman S. The radiological dating of injuries. Archives of disease in childhood. 1992; 67(9): 1063. <https://doi.org/10.1136/adc.67.9.1063>
- [29]. Ben-Ami R. Treatment of invasive candidiasis: A narrative review. Journal of Fungi. 2018; 16;4(3):97. <https://doi.org/10.3390/jof4030097>
- [30]. Li Y, Theuretzbacher U, Clancy CJ, Nguyen MH, Derendorf H. Pharmacokinetic/pharmacodynamic profile of posaconazole. Clinical pharmacokinetics. 2010; 49(6):379-96. <https://doi.org/10.2165/11319340-000000000-00000>
- [31]. Krishna G, Moton A, Ma L, Medlock MM, McLeod J. Pharmacokinetics, and absorption of posaconazole oral suspension under various gastric conditions in healthy volunteers. Antimicrobial agents and chemotherapy. 2009; 53(3):958-66. <https://doi.org/10.1128/AAC.01034-08>
- [32]. Van der Elst KC, Brouwers CH, van den Heuvel ER, van Wanrooy MJ, Uges DR, van der Werf TS, Kosterink JG, Span LF, Alffenaar JW. Subtherapeutic posaconazole exposure and treatment outcome in patients with invasive fungal disease. Therapeutic Drug Monitoring.2015;37(6):766-71.
- [33]. Alghamdi S, Asif M. The Posaconazole and Its Pharmacologic and clinical Uses: An Antifungal Drugs: Potentials of Posaconazole. Journal of Biological Studies. 2022; 30;5(2):285-319.
- [34]. Jain AK, Jain S, Abourehab MA, Mehta P, Kesharwani P. An insight on topically applied formulations for management of various skin disorders. Journal of Biomaterials Science, Polymer Edition. 2022; 19:1-27.)
- [35]. Sharadha M, Gowda DV, Gupta V, Akhila AR. An overview on topical drug delivery system-updated review. International Journal of Research in Pharmaceutical Sciences. 2020; 11(1):368-85. <https://doi.org/10.26452/ijrps.v11i1.1831>
- [36]. Singhvi G, Patil S, Girdhar V, Dubey SK. Nanocarriers for topical drug delivery: approaches and advancements. Nanoscience & Nanotechnology-Asia. 2019; 9(3):329-36. <https://doi.org/10.2174/2210681208666180320122534>
- [37]. Chavda VP. Nanotherapeutics and nanobiotechnology. In Applications of Targeted Nano Drugs and Delivery Systems 2019; 1:1-13. <https://doi.org/10.1016/B978-0-12-814029-1.00001-6>
- [38]. Zhang Z, McClements DJ. Overview of nanoemulsion properties: stability, rheology, and appearance. In Nanoemulsions 2018; (pp. 21-49). <https://doi.org/10.1016/B978-0-12-811838-2.00002-3>
- [39]. Chellapa P, Mohamed AT, Keleb EI, Elmahgoubi A, Eid AM, Issa YS, Elmarzughi NA. Nanoemulsion and nanoemulgel as a topical formulation. International Organization of Scientific Research 2015; 5(10):43-7.
- [40]. Ahmad J, Gautam A, Komath S, Bano M, Garg A, Jain K. Topical nano-emulgel for skin disorders: Formulation approach and characterization. Recent patents on anti-infective drug discovery. 2019; 14(1):36-48