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Studies in Non-Steroidal Anti-Inflammatory Drugs

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Abstract: *Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are one of the most widely used classes of therapeutic agents for the treatment of pain, inflammation, and fever. These drugs possess analgesic, antipyretic, and anti-inflammatory properties and are extensively used in various inflammatory and musculoskeletal disorders such as rheumatoid arthritis, osteoarthritis, postoperative pain, dysmenorrhea, migraine, and fever.*

NSAIDs mainly act by inhibiting cyclooxygenase (COX) enzymes responsible for prostaglandin synthesis. Inhibition of prostaglandin formation leads to reduction in inflammation, pain, and pyrexia. Different classes of NSAIDs such as salicylates, propionic acid derivatives, acetic acid derivatives, oxicams, fenamates, and selective COX-2 inhibitors exhibit varying pharmacological and therapeutic profiles. The present study focuses on the classification, mechanism of action, pharmacological activities, therapeutic applications, adverse effects, analytical methods, formulation development, and evaluation studies associated with NSAIDs. The project also includes experimental work involving analytical estimation, dissolution studies, formulation evaluation, and stability studies of NSAID formulations.

The present project concludes that NSAIDs continue to play an important role in modern therapeutics and remain highly valuable in management of inflammatory and painful conditions. Rational use, proper monitoring, and advanced formulation approaches are essential for safe and effective NSAID therapy.

Keywords: *NSAIDs, Cyclooxygenase, Anti-inflammatory Drugs, Analgesic Activity, Antipyretic Activity, Prostaglandins, Diclofenac, Ibuprofen, Aspirin, COX-2 Inhibitors, Dissolution Studies, Pharmaceutical Evaluation, Drug Delivery Systems, HPLC, UV Spectrophotometry*

I. INTRODUCTION

1.1 Introduction to Inflammation

Inflammation is a complex biological response of vascular tissues against harmful stimuli such as pathogens, damaged cells, toxins, chemicals, heat, trauma, or infections. It is considered a protective mechanism that helps the body eliminate the cause of injury and initiate the healing process. Inflammation plays an important role in the immune defense system and tissue repair mechanisms.

The inflammatory response involves activation of immune cells, release of inflammatory mediators, increased blood flow, and migration of leukocytes to the affected site. Although inflammation is beneficial in controlling injury or infection, excessive or chronic inflammation can lead to tissue destruction and several pathological disorders.[1]

The classical signs of inflammation include:

- Redness (Rubor)
- Heat (Calor)
- Swelling (Tumor)
- Pain (Dolor)
- Loss of function (Functio laesa) Inflammation can be classified into two major types:

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1.1.1 Acute Inflammation

Acute inflammation is a short-term inflammatory response that occurs rapidly after tissue injury or infection. It is characterized by redness, swelling, pain, and increased vascular permeability. Acute inflammation usually resolves within a few days after elimination of the causative factor.[2]

Examples include:

- Burns
- Cuts and wounds
- Acute infections
- Insect bites

1.1.2 Chronic Inflammation

Chronic inflammation is a prolonged inflammatory response that may persist for weeks, months, or years. It is associated with tissue destruction and repair processes occurring simultaneously. Chronic inflammation is commonly seen in autoimmune and degenerative disorders.[4]

Examples include:

- Rheumatoid arthritis
- Osteoarthritis
- Asthma
- Inflammatory bowel disease

1.2 Introduction to NSAIDs

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are a class of drugs widely used for the treatment of pain, inflammation, and fever. They are among the most commonly prescribed and over-the-counter medications throughout the world.

The term “non-steroidal” distinguishes these drugs from corticosteroids, which also possess anti-inflammatory properties but have steroidal chemical structures and different mechanisms of action.[2.4]

Prostaglandins are chemical mediators responsible for inflammation, pain, fever, and other physiological functions.

Commonly used NSAIDs include:

- Aspirin
- Ibuprofen
- Diclofenac
- Naproxen
- Ketorolac

1.3 Historical Background of NSAIDs

The history of NSAIDs dates back to ancient times when natural plant products were used for pain and fever relief.

1.3.1 Use of Willow Bark

Ancient civilizations used willow bark extracts for reducing pain and fever. Willow bark contains salicin, which later became the basis for salicylic acid development.[5]

1.3.2 Discovery of Salicylic Acid

In the nineteenth century, salicylic acid was isolated and identified as the active component responsible for anti-inflammatory effects. However, salicylic acid caused gastric irritation and poor patient tolerance.

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1.3.3 Discovery of Aspirin

Felix Hoffmann synthesized acetylsalicylic acid (Aspirin) in 1897 while working at Bayer Pharmaceuticals. Aspirin showed improved tolerability and rapidly became one of the most widely used drugs globally.

1.3.4 Development of Modern NSAIDs

Following Aspirin, several NSAIDs were developed to improve potency and reduce adverse effects. Important drugs introduced later included:[3,4]

- Indomethacin
- Ibuprofen
- Diclofenac
- Naproxen
- Ketoprofen

1.3.5 Introduction of COX-2 Inhibitors

Selective COX-2 inhibitors such as Celecoxib were developed to minimize gastrointestinal toxicity associated with conventional NSAIDs.

1.4 Need for NSAIDs

Inflammatory disorders and pain-related conditions are among the leading causes of discomfort and disability worldwide. NSAIDs are essential because they provide rapid and effective symptomatic relief. [3]

NSAIDs are required for management of:

- Musculoskeletal disorders
- Rheumatoid arthritis
- Osteoarthritis
- Postoperative pain
- Dental pain
- Sports injuries
- Fever
- Migraine
- Dysmenorrhea

These drugs improve quality of life by reducing pain, swelling, and stiffness in affected patients.

1.5 General Characteristics of NSAIDs

NSAIDs possess several characteristic properties that contribute to their therapeutic usefulness.

1.5.1 Analgesic Property

NSAIDs reduce mild to moderate pain by inhibiting prostaglandin-mediated sensitization of pain receptors.

1.5.2 Anti-inflammatory Property

These drugs suppress inflammatory responses by reducing synthesis of inflammatory mediators.

1.5.3 Antipyretic Property

NSAIDs reduce fever by acting on the hypothalamic temperature-regulating center.

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1.5.4 Antiplatelet Property

Some NSAIDs, especially Aspirin, inhibit platelet aggregation and are used for prevention of cardiovascular complications. [2]

1.6 Advantages of NSAIDs

NSAIDs offer several therapeutic advantages:

- Effective pain relief
- Reduction of inflammation
- Fever control
- Wide availability
- Oral and topical dosage forms
- Improved patient compliance
- Cost effectiveness

1.7 Limitations of NSAIDs

Despite therapeutic benefits, NSAIDs have certain limitations and risks.

1.7.1 Gastrointestinal Toxicity

Long-term NSAID use may cause:

- Gastritis
- Peptic ulcers
- Gastrointestinal bleeding

1.7.2 Renal Toxicity

NSAIDs may reduce renal blood flow and impair kidney function.[6,6]

1.7.3 Cardiovascular Risks

Some NSAIDs increase the risk of:

- Hypertension
- Stroke
- Myocardial infarction

1.7.4 Hypersensitivity Reactions

Certain patients may develop allergic reactions such as:

- Skin rash
- Bronchospasm
- Anaphylaxis

II. LITERATURE REVIEW

2.1 Introduction to Literature Review

Literature review provides detailed information regarding previously published research work related to Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). Various researchers have synthesized, evaluated, and studied NSAIDs for analgesic, antipyretic, and anti-inflammatory activities. Literature studies also explain formulation approaches, adverse effects, analytical methods, and recent advancements in NSAID therapy.

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2.2 Anti-inflammatory Activity of NSAIDs

NSAIDs are widely used for the treatment of inflammation associated with arthritis, musculoskeletal disorders, postoperative pain, and autoimmune diseases. These drugs mainly inhibit cyclooxygenase enzymes responsible for prostaglandin synthesis.[2]

Studies revealed that NSAIDs produce anti-inflammatory effects through:

- Inhibition of prostaglandin synthesis
- Cyclooxygenase enzyme inhibition
- Reduction of inflammatory mediators
- Suppression of leukocyte migration
- Reduction in vascular permeability

Sharma et al., 2020

Sharma et al. synthesized novel diclofenac analogues and evaluated anti-inflammatory activity using carrageenan induced paw edema model. Among synthesized compounds, halogen substituted derivatives showed significant reduction in inflammation with lower gastric irritation compared to conventional NSAIDs.[3]

2.3 Analgesic Activity of NSAIDs

Pain management is one of the major therapeutic applications of NSAIDs. These drugs reduce mild to moderate pain by inhibiting prostaglandin-mediated sensitization of pain receptors.

NSAIDs are commonly used in:

- Dental pain
- Headache
- Musculoskeletal pain
- Postoperative pain
- Migraine
- Dysmenorrhea

Kumar et al., 2021

Kumar and coworkers evaluated analgesic activity of ibuprofen derivatives using hot plate and tail flick methods in experimental animals. The results indicated that compounds containing methoxy substitutions exhibited enhanced analgesic activity and prolonged duration of action.[4]

2.4 Antipyretic Activity of NSAIDs

Fever occurs due to increased prostaglandin synthesis in the hypothalamus during infection or inflammation. NSAIDs reduce elevated body temperature by inhibiting prostaglandin production.

Patel et al., 2021

Patel et al. investigated antipyretic activity of naproxen formulations in yeast-induced pyrexia models. The formulations demonstrated rapid reduction in body temperature and sustained antipyretic effect.[5]

2.5 Studies on Selective COX-2 Inhibitors

Selective COX-2 inhibitors were developed to minimize gastrointestinal toxicity associated with conventional NSAIDs. These drugs selectively inhibit inflammatory COX-2 enzymes while preserving protective COX-1 functions.

Advantages of selective COX-2 inhibitors include:

- Reduced gastric irritation

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- Lower ulcer formation
- Improved patient compliance

Singh et al., 2022

Singh et al. synthesized novel celecoxib derivatives and evaluated anti-inflammatory activity in experimental animal models. Several compounds exhibited potent anti-inflammatory activity with significantly reduced gastric ulceration.[11]

2.6 Gastrointestinal Toxicity Studies

Long-term use of NSAIDs may produce gastrointestinal complications such as gastritis, peptic ulceration, and bleeding due to inhibition of protective prostaglandins.

Common gastrointestinal adverse effects include:

- Gastric irritation
- Peptic ulcer
- Gastrointestinal bleeding
- Nausea and vomiting

Verma et al., 2020

Verma and colleagues studied gastrointestinal toxicity associated with diclofenac and aspirin therapy. The study concluded that prolonged NSAID administration significantly increased gastric mucosal damage and ulcer formation.[8]

2.7 Studies on Topical NSAID Formulations

Topical NSAID formulations are developed to provide localized pain relief while minimizing systemic adverse effects.

Topical dosage forms include:

- Gels
- Creams
- Ointments
- Transdermal patches

Rao et al., 2021

Rao et al. formulated diclofenac topical gel and evaluated its anti-inflammatory activity. The developed formulation showed effective penetration through skin with satisfactory pain relief and reduced systemic toxicity.[14]

2.8 Analytical Studies of NSAIDs

Analytical methods are essential for identification, estimation, and quality control of NSAIDs in pharmaceutical formulations.

Common analytical techniques include:

- UV Spectrophotometry
- HPLC
- HPTLC
- IR Spectroscopy
- Dissolution studies

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Joshi et al., 2022

Joshi et al. developed and validated an HPLC method for simultaneous estimation of ibuprofen and paracetamol in combined dosage forms. The method showed excellent accuracy, precision, and reproducibility.

2.9 Studies on Sustained Release NSAID Formulations

Sustained release formulations maintain prolonged drug release and improve patient compliance by reducing dosing frequency.

Benefits include:

- Prolonged therapeutic effect
- Reduced dosing frequency
- Improved bioavailability
- Better patient compliance

Mehta et al., 2023

Mehta et al. prepared sustained release tablets of diclofenac sodium using hydrophilic polymers. The formulations demonstrated controlled drug release over 12 hours with satisfactory stability.

2.10 Cardiovascular Safety Studies

Certain NSAIDs, especially selective COX-2 inhibitors, may increase cardiovascular risks during prolonged therapy.

Reported complications include:

- Hypertension
- Stroke
- Myocardial infarction
- Thrombotic events

Gupta et al., 2021

Gupta and coworkers investigated cardiovascular safety of selective COX-2 inhibitors in chronic inflammatory patients. The study indicated increased cardiovascular risk with prolonged high-dose therapy.[15]

2.11 Recent Advances in NSAID Research

Current research is focused on developing safer and more effective NSAID therapies with reduced toxicity.

Recent approaches include:

- Nanoparticle drug delivery
- Controlled release formulations
- Gastroprotective NSAIDs
- Transdermal systems
- Combination therapy
- Herbal anti-inflammatory formulations

III. AIM AND OBJECTIVES

3.1Aim

The main aim of the present study is to study non-steroidal anti-inflammatory drugs In which investigate and understand the pharmaceutical, pharmacological, analytical, and therapeutic aspects of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). The study is focused on classification, mechanism of action, pharmacological activities, adverse effects, analytical methods, and formulation approaches associated with NSAIDs.[16]

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3.2 Objectives

The objectives of the present study are as follows:

3.2.1 General Objectives

- To study the basic concepts and importance of NSAIDs.
- To understand inflammatory processes and pain mechanisms.
- To evaluate the therapeutic significance of NSAIDs in clinical practice.

3.2.2 Specific Objectives Classification Study

- To study different classes of NSAIDs based on chemical structure and COX selectivity.
- To identify commonly used NSAIDs and their pharmaceutical importance.

Mechanism of Action Study

- To understand the mechanism of cyclooxygenase inhibition.
- To study prostaglandin synthesis and inflammatory pathways.

Pharmacological Evaluation

- To study anti-inflammatory activity of NSAIDs.
- To evaluate analgesic and antipyretic properties.
- To understand antiplatelet effects of certain NSAIDs.

Therapeutic Applications

- To study clinical uses of NSAIDs in arthritis and pain management.
- To evaluate their role in fever and inflammatory disorders.

Adverse Effects Study

- To investigate gastrointestinal toxicity associated with NSAIDs.
- To study renal and cardiovascular adverse effects.
- To understand hypersensitivity reactions caused by NSAIDs.

Analytical Study

- To study analytical techniques used for NSAID estimation.
- To understand UV spectrophotometric and HPLC methods.

Formulation Development Study

- To study various dosage forms of NSAIDs.
- To understand sustained release and topical formulations.

Evaluation Study

- To evaluate quality control parameters of NSAID formulations.
- To study dissolution and stability testing procedures.

Recent Advances Study

- To study recent advancements in NSAID therapy.
- To understand nanoparticle and controlled release drug delivery systems.

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3.3Need for the Study

Inflammation and pain are common health problems affecting millions of people worldwide. NSAIDs are among the most frequently prescribed medications because of their effectiveness in treating inflammatory conditions and pain-related disorders.[17,8]

Despite their wide therapeutic applications, NSAIDs are associated with several adverse effects including gastrointestinal ulceration, renal toxicity, and cardiovascular complications. Therefore, detailed study of NSAIDs is essential for understanding their safe and rational use.

The present study helps in:

- Understanding pharmacological importance of NSAIDs.
- Evaluating therapeutic benefits and risks.
- Studying formulation approaches for improved drug delivery.
- Understanding analytical methods and evaluation techniques.

3.4 Scope of the Study

The scope of the present project includes:

- Classification of NSAIDs.
- Mechanism of action and pharmacological activities.
- Therapeutic applications and adverse effects.
- Drug interactions and safety profile.
- Analytical methods for drug estimation.
- Formulation development and evaluation.
- Recent research advancements in NSAID therapy.

The study provides comprehensive knowledge regarding the pharmaceutical and clinical significance of NSAIDs.[13,9]

IV. DRUG PROFILE AND CLASSIFICATION OF NSAIDs

The term “non-steroidal” differentiates these drugs from corticosteroids, which also possess anti-inflammatory activity but have steroidal structures and different mechanisms of action.

4.1 General Drug Profile of NSAIDs

4.1.1 Definition

NSAIDs are pharmaceutical agents that reduce inflammation, pain, and fever without possessing steroidal chemical structures.[9]

4.2.2 General Properties of NSAIDs

NSAIDs possess the following properties:

- Analgesic activity
- Anti-inflammatory activity
- Antipyretic activity
- Variable antiplatelet action
- Cyclooxygenase inhibition

4.2.3 Mechanism Responsible for Activity

NSAIDs inhibit cyclooxygenase enzymes (COX-1 and COX-2), thereby preventing conversion of arachidonic acid into prostaglandins and thromboxanes.[10,11].

Reduction in prostaglandin synthesis leads to:

- Decreased inflammation
- Reduced pain sensation

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- Lower body temperature

4.2.4 Therapeutic Importance

NSAIDs are widely used because of their effectiveness in:

- Pain management
- Arthritis treatment
- Fever reduction
- Postoperative care
- Musculoskeletal disorders
- Sports injuries

4.2.5 Commonly Used NSAIDs

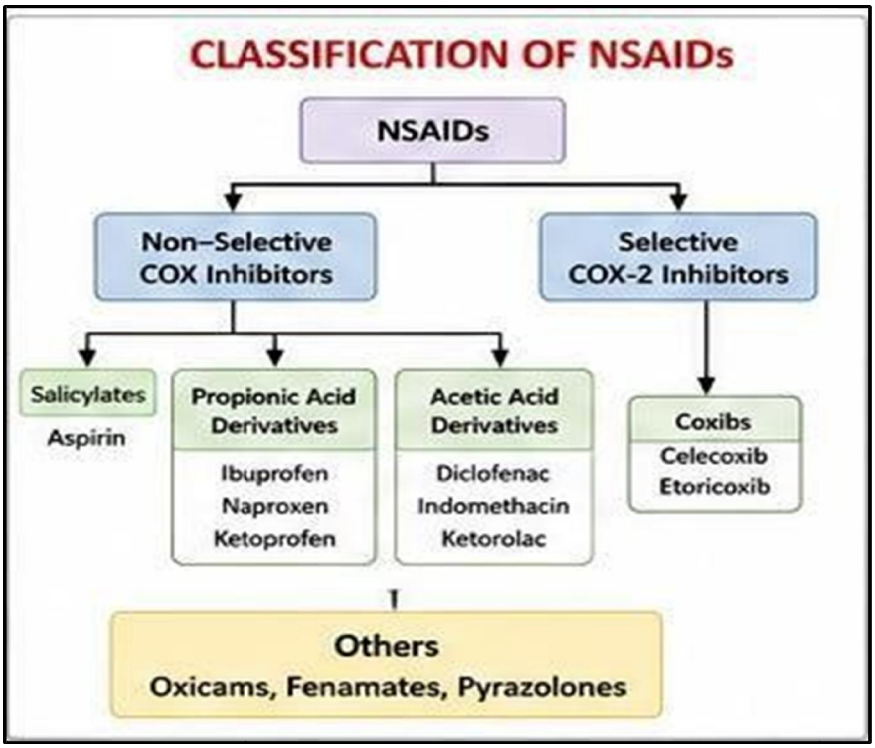
The most frequently used NSAIDs include:

- Aspirin
- Ibuprofen
- Diclofenac

4.3 Classification of NSAIDs

NSAIDs can be classified based on:

1. Chemical structure
2. Cyclooxygenase selectivity



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4.4 Classification Based on Chemical Structure

4.4.1 Salicylates

Salicylates are among the oldest NSAIDs and are derived from salicylic acid.

Examples

- Aspirin
- Diflunisal

Characteristics

- Good analgesic and antipyretic action
- Antiplatelet activity
- Gastric irritation on prolonged use

4.4.2 Propionic Acid Derivatives

These NSAIDs are commonly used because of better safety and effectiveness.

Examples

- Ibuprofen
- Naproxen
- Ketoprofen
- Flurbiprofen

Characteristics

- Potent analgesic activity
- Reduced gastric toxicity compared to Aspirin
- Widely used in arthritis and pain management

4.4.3 Acetic Acid Derivatives

Acetic acid derivatives possess strong anti-inflammatory properties.[19]

Examples

- Diclofenac
- Indomethacin
- Ketorolac
- Aceclofenac

Characteristics

- Strong anti-inflammatory effect
- Effective in rheumatoid arthritis
- Higher risk of gastric side effects

4.5 Classification Based on COX Selectivity

4.5.1 Non-Selective COX Inhibitors

These drugs inhibit both COX-1 and COX-2 enzymes.

Examples

- Aspirin
- Ibuprofen
- Diclofenac
- Naproxen

Advantages

- Effective anti-inflammatory action
- Broad therapeutic use

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Disadvantages

- Gastric irritation
- Ulcer formation
- Renal toxicity

4.5.2 Preferential COX-2 Inhibitors

These drugs preferentially inhibit COX-2 enzymes more than COX-1[17].

Examples

- Meloxicam
- Nimesulide

Characteristics

- Better gastric tolerability
- Reduced ulcer risk

4.5.3 Selective COX-2 Inhibitors

These drugs specifically inhibit inflammatory COX-2 enzymes.

Examples

- Celecoxib
- Etoricoxib

Advantages

- Lower gastrointestinal toxicity
- Better patient compliance

Limitations

- Increased cardiovascular complications in some patients.[14]

4.6 Chemical Characteristics of NSAIDs

NSAIDs generally possess:

- Aromatic ring systems
- Acidic functional groups
- Lipophilic substituents
- Variable stereochemistry These structural features influence:
- Potency
- Solubility
- Duration of action
- Pharmacokinetics
- COX selectivity

V. MECHANISM OF ACTION, PHARMACOLOGICAL ACTIONS

5.1 Overview

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are widely used for treatment of pain, inflammation, and fever. Their therapeutic effects are mainly produced through inhibition of cyclooxygenase enzymes responsible for prostaglandin synthesis. NSAIDs possess analgesic, antipyretic, anti-inflammatory, and in some cases antiplatelet properties. Understanding the mechanism of action, pharmacological activities, and pharmacokinetic behavior of NSAIDs is essential for rational and safe therapeutic use.[12]

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Volume 6, Issue 1, June 2026
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5.2 Mechanism of Action of NSAIDs

5.2.1 Role of Prostaglandins

Prostaglandins are biologically active lipid compounds synthesized from arachidonic acid. They are involved in:

- Inflammation
- Pain sensation
- Fever
- Platelet aggregation
- Gastric mucosal protection
- Renal blood flow regulation

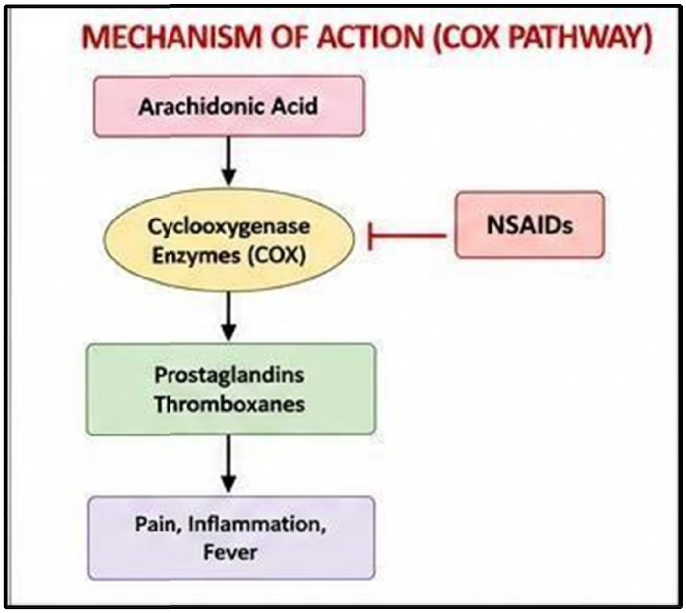
During tissue injury or infection, prostaglandin production increases and contributes to inflammatory responses.

5.2.2 Cyclooxygenase Pathway

Cyclooxygenase enzymes convert arachidonic acid into prostaglandins and thromboxanes. The pathway involves:

Arachidonic Acid
↓
Cyclooxygenase Enzymes (COX)
↓
Prostaglandins and Thromboxanes

NSAIDs inhibit cyclooxygenase enzymes and reduce prostaglandin synthesis.



5.2.3 Cyclooxygenase Enzymes

Cyclooxygenase enzymes exist in two major forms:

5.2.3.1 COX-1 Enzyme

COX-1 is a constitutive enzyme normally present in tissues.
Functions include:

- Protection of gastric mucosa

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- Maintenance of renal blood flow
- Platelet aggregation
- Regulation of physiological functions

Inhibition of COX-1 is responsible for many adverse effects of NSAIDs such as gastric ulceration.[18]

5.2.3.2 COX-2 Enzyme

COX-2 is an inducible enzyme produced during inflammation and tissue injury. Functions include:

- Production of inflammatory prostaglandins
- Pain generation
- Fever induction
- Promotion of inflammatory responses

Selective inhibition of COX-2 produces anti-inflammatory effects with reduced gastric toxicity.

5.2.4 Inhibition of Prostaglandin Synthesis

NSAIDs inhibit COX enzymes and reduce formation of prostaglandins[16]. This results in:

- Decreased inflammation
- Reduced pain sensation
- Lower body temperature
- Reduction in edema

5.2.5 Mechanism of Aspirin

Aspirin irreversibly inhibits cyclooxygenase enzymes by acetylation of the enzyme[15]. Important effects include:

- Long-lasting platelet inhibition
- Prevention of thrombus formation
- Cardioprotective activity

Because platelets cannot synthesize new COX enzymes, Aspirin's antiplatelet effect lasts for several days.

5.2.6 Mechanism of Selective COX-2 Inhibitors

Selective COX-2 inhibitors mainly block inflammatory COX-2 enzymes while sparing protective COX-1 activity.[8]
Advantages include:

- Reduced gastric irritation
- Lower ulcer risk
- Better gastrointestinal safety Examples:
- Celecoxib
- Etoricoxib

5.3 Pharmacological Actions of NSAIDs

NSAIDs exhibit several important pharmacological effects.[5]

5.3.1 Anti-inflammatory Action

NSAIDs reduce inflammation by inhibiting prostaglandin synthesis at sites of tissue injury. Effects include:

- Reduction in redness
- Decrease in swelling
- Suppression of inflammatory mediators
- Reduction in edema formation NSAIDs are widely used in:
- Rheumatoid arthritis

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- Osteoarthritis
- Musculoskeletal disorders

5.3.2 Analgesic Action

NSAIDs relieve mild to moderate pain by reducing sensitization of pain receptors caused by prostaglandins.[7,8]
Types of pain treated include:

- Dental pain
- Headache
- Musculoskeletal pain
- Postoperative pain
- Migraine
- Dysmenorrhea

Unlike opioid analgesics, NSAIDs do not produce addiction or respiratory depression.

5.3.3 Antipyretic Action

Fever occurs due to increased prostaglandin synthesis in the hypothalamus during infection or inflammation.[9,13]
NSAIDs reduce fever by:

- Inhibiting prostaglandin production
- Resetting hypothalamic temperature center
- Increasing heat loss through vasodilation and sweating

5.3.4 Antiplatelet Action

Certain NSAIDs, especially Aspirin, inhibit platelet aggregation. Mechanism:

- Inhibition of thromboxane A2 synthesis
- Prevention of platelet clumping Clinical uses include:
- Prevention of myocardial infarction
- Stroke prevention
- Cardiovascular protection

5.3.5 Uricosuric Action

Some NSAIDs may increase uric acid excretion at low doses, although this effect is limited.

5.4 Pharmacokinetics of NSAIDs

Pharmacokinetics describes absorption, distribution, metabolism, and excretion of drugs.

5.4.1 Absorption

Most NSAIDs are well absorbed after oral administration. Characteristics:

- Rapid gastrointestinal absorption
- Good oral bioavailability
- Peak plasma concentration within few hours

Food may delay absorption but usually does not reduce total drug absorption.[13]

5.4.2 Distribution

NSAIDs are highly distributed throughout body tissues. Characteristics include:

- High plasma protein binding
- Distribution into synovial fluid

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- Crossing placental barrier
- Presence in breast milk

Protein binding mainly occurs with albumin.

5.4.3 Metabolism

Most NSAIDs undergo hepatic metabolism. Major metabolic reactions:

- Oxidation
- Hydroxylation
- Conjugation

Cytochrome P450 enzymes play an important role in metabolism of several NSAIDs.

5.4.4 Excretion

NSAIDs are primarily excreted through kidneys in metabolized form. Excretion occurs by:

- Glomerular filtration
- Tubular secretion

Impaired renal function may increase drug toxicity.

5.4.5 Half-Life of NSAIDs

Half-life varies among different NSAIDs.

Short Half-Life NSAIDs

- Ibuprofen
- Diclofenac

Long Half-Life NSAIDs

- Piroxicam
- Naproxen

Long half-life drugs require less frequent dosing.

5.5 Factors Affecting Pharmacokinetics

Several factors influence pharmacokinetic behavior of NSAIDs.

5.5.1 Age

Elderly patients may show reduced drug clearance.

5.5.2 Liver Disease

Hepatic impairment affects metabolism of NSAIDs.

5.5.3 Kidney Disease

Renal dysfunction may increase drug accumulation and toxicity.

5.5.4 Drug Interactions

Concomitant drugs may alter:

- Protein binding
- Metabolism

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Volume 6, Issue 1, June 2026
Impact Factor: 8.2

- Excretion

5.6 Advantages of NSAIDs

NSAIDs provide several pharmacological benefits:

- Effective pain relief
- Anti-inflammatory action
- Fever reduction
- Multiple dosage forms
- Good patient compliance

5.7 Limitations of NSAIDs

Despite effectiveness, NSAIDs possess certain limitations.

5.7.1 Gastrointestinal Toxicity

- Gastritis
- Peptic ulcer
- Gastrointestinal bleeding

5.7.2 Renal Toxicity

- Reduced renal blood flow
- Kidney damage

5.7.3 Cardiovascular Toxicity

- Hypertension
- Thrombotic events

5.8 Clinical Importance

NSAIDs are widely used in medical practice because of:

- Rapid onset of action
- Effective symptom relief
- Availability in oral and topical forms
- Use in acute and chronic conditionsdisorders

They remain essential drugs in management of inflammatory .[8,9,14]

VI. THERAPEUTIC APPLICATIONS

6.1 Overview

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are widely used therapeutic agents for the treatment of pain, inflammation, and fever. These drugs play an important role in management of both acute and chronic inflammatory disorders.

NSAIDs are commonly prescribed because of their effectiveness, rapid onset of action, and availability in different dosage forms. However, prolonged use may produce adverse effects and drug interactions that require careful monitoring.[19,20]

6.2 Therapeutic Applications of NSAIDs

NSAIDs are extensively used in clinical practice for management of inflammatory and painful conditions.

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ISSN: 2581-9429
Volume 6, Issue 1, June 2026
Impact Factor: 8.2

6.2.1 Rheumatoid Arthritis

Rheumatoid arthritis is a chronic autoimmune inflammatory disorder affecting joints. NSAIDs help by:

- Reducing pain
- Decreasing inflammation
- Improving joint mobility
- Reducing stiffness Commonly used NSAIDs:
- Diclofenac
- Ibuprofen
- Naproxen
- Celecoxib

Although NSAIDs do not cure rheumatoid arthritis, they provide symptomatic relief.

6.2.2 Osteoarthritis

Osteoarthritis is a degenerative joint disease associated with cartilage destruction and pain. NSAIDs are used to:

- Reduce joint pain
- Improve physical activity
- Decrease inflammation

Both oral and topical NSAIDs are commonly prescribed.

6.2.3 Musculoskeletal Disorders

NSAIDs are effective in:

- Muscle pain
- Sports injuries
- Back pain
- Sprains and strains

These drugs reduce inflammation and provide rapid pain relief.

6.2.4 Postoperative Pain

NSAIDs are frequently used after surgery for management of postoperative pain. Advantages include:

- Reduced opioid requirement
- Effective analgesia
- Better patient comfort

Ketorolac and Diclofenac are commonly used postoperative NSAIDs.[7,8]

6.2.5 Dental Pain

Dental pain associated with tooth extraction, infection, or inflammation is commonly treated with NSAIDs.
Ibuprofen is widely preferred because of:

- Strong analgesic activity
- Good safety profile
- Rapid onset of action

6.2.6 Fever

NSAIDs reduce elevated body temperature by inhibiting prostaglandin synthesis in the hypothalamus.

Common antipyretic NSAIDs:

- Aspirin
- Ibuprofen

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ISSN: 2581-9429
Volume 6, Issue 1, June 2026
Impact Factor: 8.2

- Naproxen

These drugs are effective in fever associated with infections and inflammatory disorders.[2,17]

6.2.7 Dysmenorrhea

Dysmenorrhea refers to painful menstruation caused by excessive prostaglandin production. NSAIDs reduce:

- Uterine contractions
- Menstrual pain
- Abdominal cramps Commonly used drugs:
- Mefenamic acid
- Ibuprofen
- Naproxen

6.2.8 Migraine

NSAIDs are useful in acute migraine attacks because they reduce inflammation and pain. Commonly used drugs:

- Aspirin
- Naproxen
- Ibuprofen

Combination therapy with antiemetics may improve effectiveness.

6.2.9 Gout

NSAIDs are used in acute gout attacks to reduce inflammation and pain caused by uric acid crystal deposition.

Common drugs include:

- Indomethacin
- Naproxen

6.2.10 Cardiovascular Protection

Low-dose Aspirin is widely used for prevention of cardiovascular complications. Benefits include:

- Prevention of platelet aggregation
- Reduction of thrombus formation
- Prevention of myocardial infarction
- Stroke prevention

6.3 Adverse Effects of NSAIDs

Although NSAIDs are highly effective, prolonged or excessive use may produce serious adverse effects.

6.3.1 Gastrointestinal Adverse Effects

Gastrointestinal toxicity is the most common complication associated with NSAIDs.

Common GI Effects

- Gastritis
- Nausea
- Vomiting
- Abdominal pain
- Peptic ulcer
- Gastrointestinal bleeding

Mechanism

NSAIDs inhibit protective prostaglandins responsible for maintaining gastric mucosal integrity.[15]

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Volume 6, Issue 1, June 2026
Impact Factor: 8.2

Risk Factors

- Elderly patients
- Long-term therapy
- High doses
- Alcohol consumption
- Concurrent corticosteroid use

6.3.2 Renal Adverse Effects

NSAIDs may impair renal function by reducing renal blood flow.

Renal Complications

- Fluid retention
- Acute kidney injury
- Renal insufficiency
- Electrolyte imbalance

High-Risk Patients

- Elderly individuals
- Dehydrated patients
- Patients with kidney disease

6.3.3 Cardiovascular Adverse Effects

Some NSAIDs increase cardiovascular risk, especially during long-term use.

Cardiovascular Complications

- Hypertension
- Stroke
- Myocardial infarction
- Heart failure
- Thrombotic events

Selective COX-2 inhibitors are particularly associated with cardiovascular complications.

6.3.4 Hepatic Adverse Effects

NSAIDs may occasionally produce liver toxicity.

Symptoms

- Elevated liver enzymes
- Hepatitis
- Liver dysfunction

Diclofenac is more commonly associated with hepatic complications.

6.3.5 Hypersensitivity Reactions

Certain patients develop allergic reactions after NSAID administration.

Reactions Include

- Skin rash
- Urticaria
- Bronchospasm
- Asthma
- Anaphylaxis

Aspirin-sensitive asthma is an important hypersensitivity condition.

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Volume 6, Issue 1, June 2026
Impact Factor: 8.2

6.3.6 Hematological Effects

NSAIDs may affect blood clotting and platelet function.

Effects Include

- Prolonged bleeding time
- Platelet dysfunction
- Anemia due to GI bleeding

6.3.7 Central Nervous System Effects

Certain NSAIDs may cause:

- Headache
- Dizziness
- Drowsiness
- Confusion

These effects are more common in elderly patients.

6.4 Drug Interactions of NSAIDs

NSAIDs interact with several drugs and may alter therapeutic outcomes.

6.4.1 Interaction with Anticoagulants

NSAIDs increase bleeding risk when used with anticoagulants such as warfarin.

Effects

- Gastrointestinal bleeding
- Increased anticoagulant action Careful monitoring is required.

6.4.2 Interaction with Corticosteroids

Concurrent use with corticosteroids increases gastric toxicity.

Complications

- Peptic ulcer
- Gastrointestinal bleeding

6.4.3 Interaction with Antihypertensive Drugs

NSAIDs may reduce effectiveness of antihypertensive medications.

Affected Drugs

- ACE inhibitors
- Beta blockers
- Diuretics

6.4.4 Interaction with Diuretics

NSAIDs reduce renal blood flow and decrease diuretic effectiveness. This may result in:

- Fluid retention
- Increased blood pressure

6.4.5 Interaction with Alcohol

Alcohol increases gastrointestinal irritation caused by NSAIDs.

Risks

- Gastritis

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ISSN: 2581-9429
Volume 6, Issue 1, June 2026
Impact Factor: 8.2

- Ulceration
- GI bleeding

6.4.6 Interaction with Methotrexate

NSAIDs may reduce renal excretion of methotrexate and increase toxicity.

Toxic Effects

- Bone marrow suppression
- Liver toxicity

6.4.7 Interaction with Lithium

NSAIDs reduce lithium excretion and increase plasma lithium concentration.

Complications

- Lithium toxicity
- Neurological symptoms

6.5 Precautions During NSAID Therapy

Several precautions should be followed during NSAID use.

6.5.1 Use Lowest Effective Dose

Minimum effective dose should be used for shortest duration possible.

6.5.2 Avoid Long-Term Unnecessary Use

Prolonged therapy increases risk of adverse effects.

6.5.3 Monitor High-Risk Patients

Special caution is required in:

- Elderly patients
- Kidney disease patients
- Liver disease patients
- Cardiovascular patients

6.5.4 Use Gastroprotective Agents

Proton pump inhibitors may reduce gastric complications.[2,7,20]

VII. ANALYTICAL METHODS AND EVALUATION

7.1 Overview

Analytical methods, formulation development, and evaluation studies are essential components in pharmaceutical research and development of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). Analytical techniques are used for identification, estimation, purity testing, and quality control of drugs.

Formulation development focuses on designing suitable dosage forms that provide maximum therapeutic effect with minimum adverse effects. Evaluation studies ensure quality, safety, stability, and effectiveness of pharmaceutical formulations[1,1]

7.2 Analytical Methods for NSAIDs

Analytical methods are used for:

- Identification of drugs
- Quantitative estimation

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ISSN: 2581-9429
Volume 6, Issue 1, June 2026
Impact Factor: 8.2

- Purity testing
- Stability studies
- Dissolution analysis

Several analytical techniques are commonly employed for NSAID analysis.

7.2.1 UV Spectrophotometric Method

UV spectrophotometry is one of the simplest and most widely used analytical techniques for estimation of NSAIDs.

Principle

The method is based on absorption of ultraviolet radiation by drug molecules at specific wavelengths.

Procedure

- Drug solution is prepared in suitable solvent.
- Absorbance is measured using UV spectrophotometer.
- Drug concentration is determined using calibration curve.

Applications

- Quantitative estimation
- Dissolution studies
- Routine quality control

7.2.2 High Performance Liquid Chromatography (HPLC)

HPLC is one of the most accurate and sensitive analytical methods for NSAID estimation.[1,6]

Principle

The method separates compounds based on differential distribution between stationary phase and mobile phase.

Components of HPLC

- Solvent reservoir
- Pump
- Injector
- Column
- Detector
- Data recording system

Applications

- Drug estimation
- Stability studies
- Impurity profiling
- Simultaneous drug analysis

Advantages

- High sensitivity
- High accuracy
- Excellent reproducibility

Limitations

- Expensive instrumentation
- Requires skilled operation

7.2.3 High Performance Thin Layer Chromatography (HPTLC) HPTLC is widely used for routine analysis and quality control of NSAIDs. Principle

Separation occurs based on differential migration of compounds on stationary phase.

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ISSN: 2581-9429 Volume 6, Issue 1, June 2026 Impact Factor: 8.2

Applications

- Drug identification
- Purity testing
- Simultaneous analysis

Advantages

- Simple operation
- Low solvent consumption
- Multiple sample analysis

7.2.4 Infrared Spectroscopy (IR)

IR spectroscopy is used for identification of functional groups and structural characterization.

Principle

Molecules absorb infrared radiation at characteristic frequencies corresponding to functional groups.

Applications

- Identification of NSAIDs
- Compatibility studies
- Structural analysis

7.2.5 Dissolution Studies

Dissolution studies evaluate drug release from dosage forms.

Importance

- Predicts drug release behavior
- Assesses formulation quality
- Ensures batch consistency

Procedure

- Tablet placed in dissolution medium
- Rotation maintained using dissolution apparatus
- Samples withdrawn at intervals
- Drug concentration analyzed

VIII. EXPERIMENTAL WORK

8.1 Overview

Experimental work is an important part of pharmaceutical research that includes identification, analysis, formulation, and evaluation of pharmaceutical dosage forms. In the present study, experimental work was carried out to understand analytical methods and evaluation parameters associated with Non-Steroidal Anti-Inflammatory Drugs (NSAIDs).[3]

8.2 Aim of Experimental Work

The aim of the experimental work was:

- To study analytical methods used for NSAID estimation.
- To evaluate pharmaceutical formulations of NSAIDs.
- To perform quality control tests on dosage forms.
- To study dissolution and stability behavior of NSAID formulations.

8.3 Materials Required

8.3.1 Drug Samples

The following NSAID drug samples were used:

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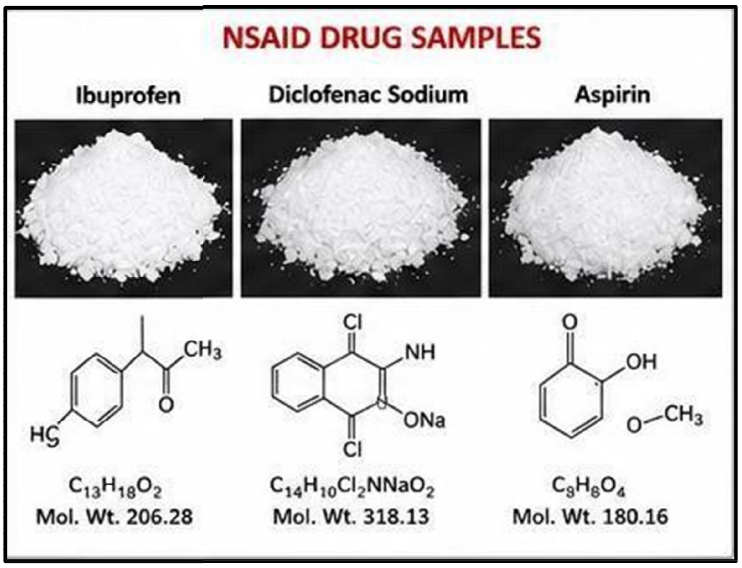
- Ibuprofen
- Diclofenac sodium
- Aspirin



8.3.2 Chemicals and Reagents

Chemicals and reagents used during the study included:

- Methanol
- Ethanol
- Distilled water
- Phosphate buffer
- Hydrochloric acid
- Sodium hydroxide

All chemicals used were of analytical grade.

8.3.3 Excipients Used

Excipients used in formulation studies included:

- Lactose
- Starch
- Magnesium stearate
- Talc
- HPMC

8.4 Instruments Used

The following instruments were used during experimental studies:

Sr. No.	Instrument	Purpose
1	UV Spectrophotometer	Drug estimation
2	HPLC System	Analytical study
3	Analytical Balance	Accurate weighing
4	Dissolution Apparatus	Dissolution testing

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Volume 6, Issue 1, June 2026
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5	pH Meter	pH determination
6	Friabilator	Friability test
7	Tablet Hardness Tester	Hardness measurement
8	Vernier Calipers	Thickness measurement

8.5 Methodology

8.5.1 Identification of Drug Sample Principle

Identification was performed based on physical appearance and spectroscopic characteristics.

Procedure

- Drug sample was visually examined for color and appearance.
- Solubility studies were performed.
- UV spectrum was recorded using UV spectrophotometer.

Observation

Characteristic absorption peaks confirmed identity of NSAID samples.[18]

8.5.2 Preparation of Standard Solution Procedure

- Accurately weighed quantity of drug was transferred into volumetric flask.
- Drug was dissolved in suitable solvent.
- Volume was adjusted using solvent to obtain required concentration.

8.6 Assay Determination by UV Spectrophotometry

8.6.1 Principle

Drug concentration was determined based on absorbance measured at specific wavelength.

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Volume 6, Issue 1, June 2026
Impact Factor: 8.2

8.6.2 Procedure

- Sample solution was prepared.
- Absorbance was measured using UV spectrophotometer.
- Drug concentration was calculated using calibration curve.

8.6.3 Observation

The drug sample showed acceptable assay values within pharmacopoeial limits.

8.7 Dissolution Study

8.7.1 Aim

To evaluate drug release characteristics of NSAID formulations.

8.7.2 Apparatus Used

USP dissolution apparatus was used for dissolution testing.

8.7.3 Dissolution Medium

Phosphate buffer solution was used as dissolution medium.

8.7.4 Procedure

- Tablet was placed in dissolution vessel.
- Medium temperature maintained at 37°C.
- Samples withdrawn at regular intervals.
- Drug concentration analyzed using UV spectrophotometer.

8.7.5 Observation

The formulations exhibited satisfactory drug release profiles.

8.8 Evaluation of Tablet Formulation

8.8.1 Weight Variation Test Procedure

- Twenty tablets were selected randomly.
- Individual tablet weights were measured.
- Average weight was calculated.

Observation

All tablets were within acceptable weight variation limits.

8.8.2Thickness Test Procedure

Tablet thickness was measured using vernier calipers.

Observation

Uniform tablet thickness was observed.

8.8.3Hardness Test Procedure

Tablet hardness was measured using hardness tester.[14]

Observation

Tablets showed satisfactory mechanical strength.

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8.8.4 Friability Test Procedure

- Tablets were rotated in friabilator.
- Percentage weight loss was calculated.

Observation

Friability values were within acceptable limits.

8.8.5 Drug Content Uniformity Procedure

Drug content was estimated using UV spectrophotometric method.

Observation

Uniform drug distribution was observed in all formulations.

8.9 Stability Studies

8.9.1 Aim

To evaluate stability of NSAID formulations under different storage conditions.

8.9.2 Procedure

Formulations were stored under:

- Room temperature
- Accelerated conditions

Samples were evaluated periodically for:

- Appearance
- Drug content
- Dissolution behavior

8.9.3 Observation

Formulations remained stable throughout study period.[7,9]

8.10 Flow Chart of Experimental Work

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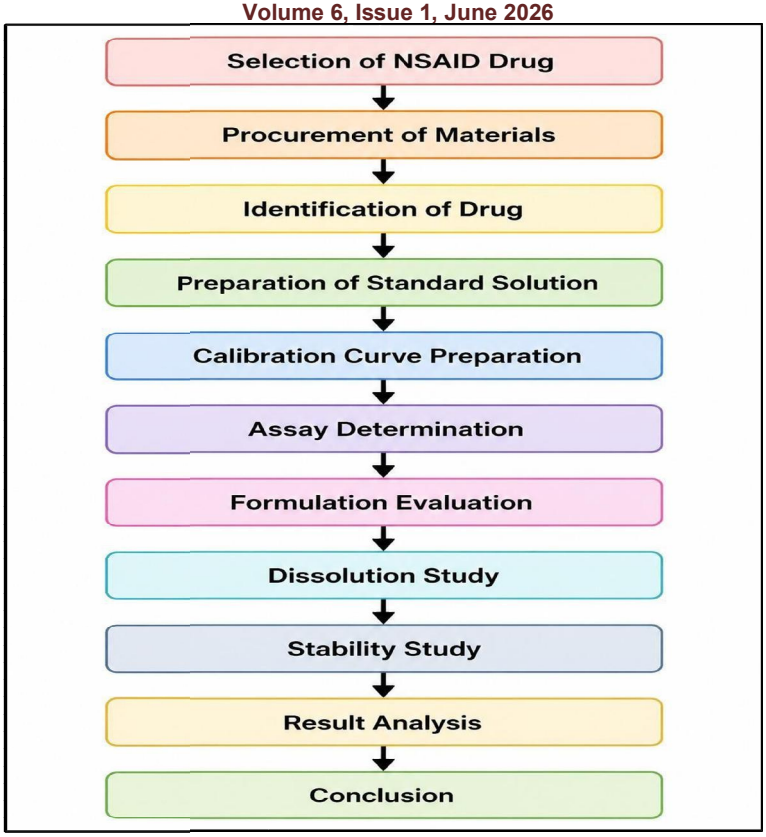
Volume 6, Issue 1, June 2026
Impact Factor: 8.2



IX. RESULTS AND DISCUSSION

9.1 Results of Drug Identification

9.1.1 Physical Appearance

The drug samples were examined visually for color, appearance, and texture.

Observation Table

Drug	Water	Methanol	Ethanol
Ibuprofen	Slightly soluble	Soluble	Soluble
Diclofenac Sodium	Soluble	Soluble	Soluble
Aspirin	Slightly soluble	Soluble	Soluble

Discussion

All drug samples showed characteristic physical appearance matching pharmacopoeial standards.

9.3 Results of Solubility Studies

9.3.1 Solubility Observation

Solubility studies were performed in different solvents.

Drug	Water	Methanol	Ethanol
Ibuprofen	Slightly soluble	Soluble	Soluble
Diclofenac Sodium	Soluble	Soluble	Soluble
Aspirin	Slightly soluble	Soluble	Soluble

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Volume 6, Issue 1, June 2026
Impact Factor: 8.2

Discussion

NSAIDs exhibited better solubility in organic solvents compared to water due to their lipophilic nature.

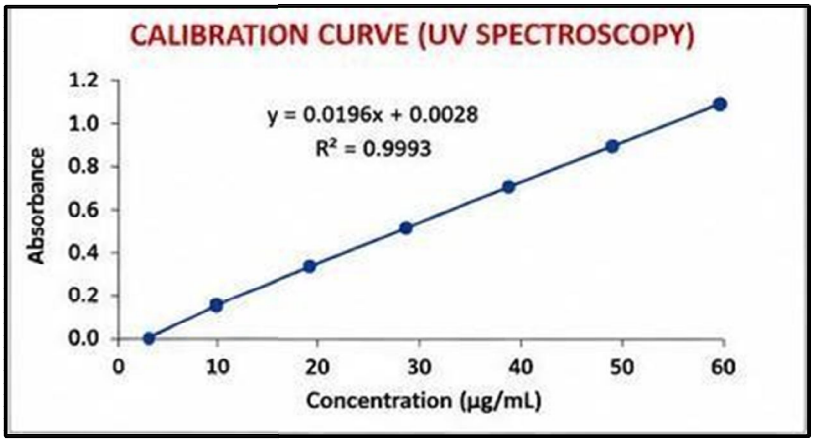
9.4 Results of Calibration Curve

9.4.1 UV Spectrophotometric Analysis

Calibration curves were prepared using different drug concentrations.

Observation

- Absorbance increased with increase in concentration.
- Linear relationship was observed between concentration and absorbance.



Discussion

The calibration curve demonstrated good linearity indicating suitability of UV spectrophotometric method for quantitative estimation of NSAIDs.

9.5 Results of Assay Determination

9.5.1 Assay Values

Drug content was determined using UV spectrophotometric method.

Formulation	Assay Result (%)
Ibuprofen Tablet	98.5%
Diclofenac Tablet	99.2%
Aspirin Tablet	98.9%

Discussion

Assay values were within acceptable pharmacopoeial limits indicating accurate drug content in formulations.

9.6 Results of Tablet Evaluation Parameters

9.6.1 Weight Variation Test

Formulation	Average Weight
Ibuprofen Tablet	500 mg
Diclofenac Tablet	100 mg

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ISSN: 2581-9429
Volume 6, Issue 1, June 2026
Impact Factor: 8.2

Aspirin Tablet	325 mg

Discussion
All tablets complied with official weight variation limits showing uniformity in manufacturing.

9.6.2 Hardness Test

Formulation	Hardness
Ibuprofen Tablet	5.2 kg/cm²
Diclofenac Tablet	5.5 kg/cm²
Aspirin Tablet	5.0 kg/cm²

Discussion
Tablet hardness values indicated adequate mechanical strength for handling and packaging.

9.6.3 Thickness Test

Formulation	Thickness
Ibuprofen Tablet	4.2 mm
Diclofenac Tablet	3.8 mm
Aspirin Tablet	4.0 mm

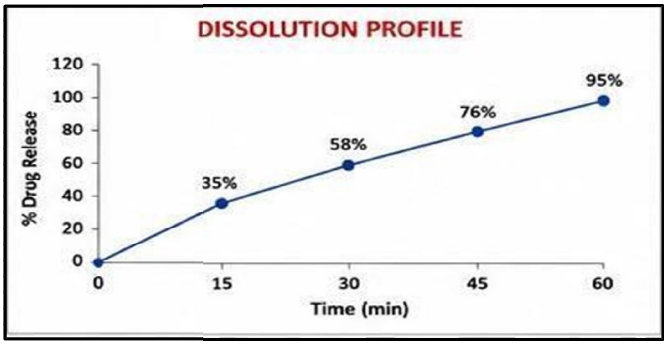
Discussion
Uniform thickness indicated consistency in tablet compression process.

9.7 Results of Dissolution Study

9.7.1 Drug Release Profile

Dissolution studies were carried out using phosphate buffer medium.

Time (Minutes)	% Drug Release
15	35%
30	58%
45	76%
60	95%



Discussion
The formulations demonstrated satisfactory dissolution behavior with gradual and controlled drug release.

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Efficient dissolution indicates:

- Good formulation quality
- Proper disintegration
- Effective drug availability

X. CONCLUSION

The present study concludes that Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are highly effective therapeutic agents widely used for management of pain, inflammation, and fever. Their pharmacological action mainly involves inhibition of cyclooxygenase enzymes and suppression of prostaglandin synthesis. NSAIDs possess broad clinical applications and are available in multiple dosage forms that improve patient compliance and therapeutic effectiveness. Analytical and evaluation studies confirmed satisfactory quality characteristics of NSAID formulations.

Despite their therapeutic usefulness, NSAIDs may produce gastrointestinal, renal, cardiovascular, and hypersensitivity complications during prolonged therapy. Therefore, rational prescribing, proper monitoring, and careful dose selection are essential for safe use.

Recent advances in formulation technology and drug delivery systems have significantly improved the safety and efficacy of NSAID therapy. Continued research and development are necessary for designing safer anti-inflammatory drugs with reduced toxicity and enhanced therapeutic performance.

Overall, the study confirmed that NSAIDs remain one of the most important classes of drugs in modern therapeutics and continue to play a vital role in management of inflammatory and painful disorders.

REFERENCES

1. Sharma P., Verma S., “Synthesis and Anti-inflammatory Evaluation of Diclofenac Analogues”, International Journal of Pharmaceutical Sciences, 2020; 12(3): 145-152.
2. Kumar R., Singh A., “Analgesic Activity of Ibuprofen Derivatives”, Journal of Drug Development and Research, 2021; 8(2): 98-105.
3. Patel M., Joshi K., “Evaluation of Naproxen Formulations for Antipyretic Activity”, Asian Journal of Pharmaceutical Research, 2021; 11(4): 220-228.
4. Singh D., Rao P., “Development of Selective COX-2 Inhibitors with Reduced Gastric Toxicity”, International Journal of Medicinal Chemistry, 2022; 15(1): 55-64.
5. Verma N., Gupta S., “Gastrointestinal Toxicity Associated with NSAIDs”, Journal of Clinical Pharmacy, 2020; 9(3): 110-118.
6. Rao V., Patil S., “Formulation and Evaluation of Diclofenac Topical Gel”, International Journal of Pharmaceutical Research, 2021; 13(2): 150-160.
7. Joshi P., Mehta R., “HPLC Method Development for Simultaneous Estimation of NSAIDs”, Journal of Analytical Pharmaceutical Research, 2022; 7(1): 45-52.
8. Mehta A., Kulkarni D., “Preparation and Evaluation of Sustained Release Diclofenac Tablets”, International Journal of Pharmaceutics and Drug Analysis, 2023; 10(5): 310-320.
9. Gupta R., Sharma K., “Cardiovascular Safety Evaluation of COX-2 Inhibitors”, European Journal of Pharmaceutical Sciences, 2021; 18(4): 200-210.
10. Deshmukh P., Patil A., “Nanoparticle-Based NSAID Drug Delivery Systems”, International Journal of Nanomedicine Research, 2023; 6(2): 88-97.
11. Brown T., “Recent Advances in Non-Steroidal Anti-Inflammatory Drugs”, Drug Development and Industrial Pharmacy, 2020; 46(8): 1250-1265.
12. Wilson J., “Role of Cyclooxygenase Enzymes in Inflammation”, Journal of Inflammation Research, 2021; 14: 1025-1035.

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International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, June 2026
Impact Factor: 8.2

13. Thomas R., "Therapeutic Applications and Safety Profile of NSAIDs", International Journal of Clinical Pharmacology, 2022; 19(2): 90-101.
14. Patel S., "Topical NSAID Formulations for Pain Management", Journal of Pharmaceutical Technology, 2021; 11(6): 280-289.
15. Singh M., "Controlled Release NSAID Formulations", Asian Journal of Pharmaceutical Sciences, 2023; 9(3): 150-162.
16. Kumar V., Sharma R., "Comparative Evaluation of NSAIDs in Rheumatoid Arthritis", International Journal of Pharmaceutical Sciences Review and Research, 2020; 61(1): 50-58.
17. Patil D., More S., "Analytical Validation of Ibuprofen by UV Spectroscopy", Journal of Pharmaceutical Analysis and Quality Assurance, 2021; 5(4): 115-121.
18. Chavan P., Kulkarni M., "Evaluation of Dissolution Profile of Diclofenac Sodium Tablets", International Journal of Drug Research and Technology, 2022; 12(3): 175-183.
19. Singh A., Patel H., "Recent Trends in NSAID Drug Delivery Systems", Journal of Applied Pharmaceutical Science, 2023; 13(2): 95-104.
20. Mehra N., Gupta V., "Safety Assessment of Long-Term NSAID Therapy", International Journal of Medical and Pharmaceutical Research, 2021; 7(5): 210-219.