WHAT HAPPENS TO MEDICINES AFTER EXPIRY? REVEALED QUALITY ASSESSMENT OF SOME FORMULATIONS!

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Abstract

The concept of expired drugs is an unboxed statement in Pharmaceutical research. “Consuming expired drugs is hazardous and life threatening” is absolutely in-evident and unproven. Common Public were misled with this kind of statements in the entertainment and media channels. An attempt was made taking three expired formulations Diclofenac sodium-50mg, Sodium Bicarbonate-1000mg and Esomeprazole-20mg with different post expired tenures. The fact we found in this attempt is that, the expired formulations are meeker in stability, quality and efficacy after expiry. However, as Pharmacist we strongly discourage usage of expired drugs and abandon their existence. It was concluded that expired drugs are just inferior in standards and specifically may not meet the Pharmacopeial requirement. The same situation is anticipated with other drugs too.

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INTRODUCTION

Drug expiration is the date after which a drug might not be suitable for use as intended. Consumers can determine the shelf life for a drug by checking its pharmaceutical packaging for an expiration date.

Drugs which are past their shelf life can decompose and either be ineffective or even harmful. However, the published expiration date is not an absolute indication that a drug has spoiled. Consumers and organizations sometimes use expired drugs for medical treatment either as a cost saving measure or because they otherwise cannot access drugs which are not expired which act is unethical.

“The date placed on the container of a drug product designating the time during which a batch of a product is expected to remain within the approved shelf-life specification if stored under defined conditions and after which it may not be used”.

Adverse effects of expired drugs are loss of efficacy, safety, potency and formation of harmful products. The grievous implication is that usage of expired antibiotics knowingly or unknowingly, not only can lead to antibiotic resistance in vivo but more likely can also lead to degradation of their active ingredients into components that can be seriously hazardous and can be fatal.

Occasionally dangerous by-products are formed that can be hazardous to body organs that can get impaired and body loses the ability to filter toxins and various chemical metabolites from the system, leading to serious health hazards. These by-products can even be carcinogenic, which if extrapolated as additional clinical failure, can lead to mortality; therefore, strict compliance with expiry dates ought not to be ignored. Expired medication may not adequately treat minor conditions (for example, minor headache, cold), or serious conditions (for example, diabetes or heart disease) becauseof reduced efficacy.

As a consequence, inadequate relief from sickness could eventually lead to longer sick days, increased absences from work/school, and lost productivity at work/school. There are many international, national and local studies which tried to explore the awareness, attitudes and practices of people regarding expired medicines. An Indian study showed that less than 72% people don't check expiry date while purchasing or taking medicines.

NEED FOR EXPIRATION DATES

The medicines are regulated by the Acts and Rules. It also regulates the stamping of expiry date on all medicines. The regulation makes it compulsory for every medicine to carry a date of expiry of potency. It is the date that is recorded on the container, label or wrapper of the medicine. This is to ensure that the customer knows the maximum time till when the medicine can last on the shelf.

LABELED EXPIRATION DATE Vs TRUE EXPIRATION

Manufacturers print expiration dates on drug bottle labels. The labeled expiration date is a manufacturer's promise for a time until which the drug will have full efficacy and be safe as manufactured. The labeled expiration date is not an indication of when a drug has become ineffective or unsafe to use. By law, pharmaceutical companies are required to set a date from the date of manufacture, usually 2 or 3 years in the future, and up until this time, they guarantee 100% efficacy of the product. This is the expiry date of the medicine. Medicines are susceptible to moisture and extremes of temperature, light, and heat.

THE EXTENT OF THE PROBLEM

Destroying and replacing drugs which have reached their expiry dates is a costly business around the world. This is estimated to cost an incredible $765 billion per year. Ensuring enough drugs are always available, up-to-date, and in-date is a huge and expensive task. Governments are also required to store antibiotics, antivirals, and vaccines for the population in case of need. This can be hugely expensive and lead to massive wastage.

SOME EXAMPLES

i) In 2012, two California scientific researchers, Lee Cantrell[2] and Roy Gerona[2] discovered a hidden supply of medicines, some of which predated 1969! Knowing these medicines were more than 30–40 years old, they set out to analyses these drugs. This included a variety of different medicines, including pain killers, antihistamines, and stimulants – all of which had remained in sealed containers. The results were amazing! 12 out of the 14 substances analyzed were still 100% potent!

ii) In another incident drugs had a prolonged, perilous journey by sea, to reach the Antarctic station, and are often stored in transit, on a ship, at sub-zero temperatures, and in high humidity. Five of these drugs were tested after they had been returned back. After having

passed their expiry dates: atropine, nifedipine, cloxacillin, and naproxen. All were found to be stable, and could indeed have been used.

iii) A very recent 2019 review of the available medical literature concluded that most drugs are effective for more than 5 years after their expiry date. However, despite this knowledge, efforts to get pharmaceutical companies to extend the expiry dates on their medicines, have so far failed.

EXPIRY DATE GUIDELINES

The shelf life of a product is determined based on the degradation of its medication or loss of its potency.

Regulatory authorities of various countries have laid down guidelines for:

- Determining expiry date / shelf life of medication
- Expiry details depending on formulation type, with respect to when a medication is to be discarded, for example, one month after opening the ophthalmic solution bottle
- Products exempted from expiry date
- When a product is considered unsafe to use and must be discarded
- Proper storage of medication
- Disposal of expired or unused medications

Examples of a few formulation types

FORMULATION TYPE	EXPIRY DETAILS
Tablets and capsules in original blister strips or container with printed expiry date	Manufacturer's expiry date, as printed on original box ormentioned in patient information leaflet
Tablets and capsules stored in dispensing bottles from pharmacy	6 months from date of dispensing, unless otherwise informed by community pharmacist
Oral liquids (in original manufacturer's packaging or amber bottles)	6 months from date of opening or follow manufacturer's guidance. For antibiotics, check with community pharmacist if notclear from label
External liquids (for example, lotions, shampoos and bath oils)	6 months from opening or manufacturer's recommendation, whichever is shorter
Sterile eye/ear/nosedrops/ointments	28 days from date of opening
Inhalers	Manufacturer's expiry date

Insulin	• Unopened: Manufacturer's expiry date when stored in afridge at a temperature between 2°C and 8°C. • Once opened: 4 weeks for insulin vials and pens, unlessotherwise stated. When in use, can be kept at normal room temperature (i.e., less than 25°C).

FACTORS TO BE CONSIDERED BEFORE TAKING EXPIRY MEDICINES:

The following factors should be taken into consideration before deciding to takeexpired medication:

Appearance of the Medicines: The actual appearance of the medicine is very important in the decision-making process -

whether to take or not. Medicines should not be taken under the followingcircumstances:

If tablets are brittle, have lost their sheen or have become discoloredIf an injectable becomes cloudy or a precipitate form

In expired ophthalmic solutions, the drug itself does not degrade, but the preservative

degrades, thereby encouraging microbial growth. So, if the solution becomes cloudy(indicating microbial growth), it should be immediately discarded

Length of Time from Manufacture: The lesser the time between the date of manufacture and time of final use, the better will be the potency of the medication **Storage Conditions:** If the medicines are stored properly in a cool and dry place, andkept unopened, the stability of the medicines will be higher

Package Type: The type of package will also determine the stability and longevity of the medicines. In this regard, an air- tight strip of tablets or capsules will be far superior to an opened screw-cap container

Formulation: The formulation is a critical factor in the stability of the drug. Generally, liquid formulations are less stable than solid formulations

THE RISKS OF EXPIRED MEDICINE:

Medicines, like everyday things, go bad after a set of period.

1. REDUCED EFFICACY:

To understand why drugs, lose their efficacy over a period of time, you have to know how they operate. Drugs work by binding themselves to the cell receptors which send out signals to the rest of the cell body, which triggers the intended reaction. For example, ibuprofen reduces pain by blocking the production of prostaglandins, a hormone that triggers pain. As less intimidating a reduced efficacy may sound, it sets a dangerous precedent.

2. DRUG ADDICTION:

As expired meds are less effective, people tend to increase the dosage to get the desired effect of the meds. This is how the country's opioid crisis begins, overprescribing and over usage of a drug will lead to developing addiction. Drug addiction is already a grave problem even with a still-good medicine.

3. LEGAL REPERCUSSIONS:

It is illegal for a person to give their prescribed medication to another person. Leaving expired meds in the house is a great way to make it happen, even without the intention of giving them away. Additionally, several states have their respective regulations regarding disposing of expired drugs.

4. ANTIBIOTIC RESISTANCE:

As mentioned earlier, antibiotics whose efficacy has waned over time can give the disease a chance to grow more resistant to it. Antibiotic resistance, as it's called, has already been a critical problem before the pandemic. It kills twice as many people in the U.S. as drug over dosage and threatens to render every antibiotic in use to be ineffective.Antibiotics are so potent that they should only be taken as prescribed by the doctor, from the dosage to the frequency of taking them. Once the time frame for the medication passes, only the doctor can determine if it stops there or continue with another batch.

5. DEATH

While there hasn't been any recorded case of someone dying from taking expired meds directly, it can happen as an indirect result. Take epinephrine as an example, a drug which is commonly used to treat life-threatening allergic reactions or anaphylaxes, when it's mistakenly used or administered, it can cause death. Multiple studies have shown that anti-allergy medicines that use epinephrine can lose most of their efficacy over time.

KEY POINTS FOR STORAGE GUIDELINES:

- ✓ Keep all medications in the original container in which they were dispensed.
- ✓ Keep medicines in their original outer packaging to protect from sunlight.
- ✓ All medicines should be stored according to the specifications in the label store in acool dry place unless it is to be stored at refrigerator or deep freezer.
- ✓ Any changes in the appearance of medicine should be brought to the notice of regulatory authority.

ACCIDENTAL CONSUMPTION OF EXPIRY MEDICINE

According to a report manufacturers also keep a margin period in the expiry date written on their medicines. For example, you can understand it in such a way that suppose there is a medicine named ABCD which is to expire in 2 years. This drug was manufactured in January 2021 and will expire in January 2023. But keeping a margin period of about 6 months on that drug, the company will give its expiry date June 2022 instead of January 2023. According to the report, some such cases have been seen in which people have filed complaints like headache, stomach pain and vomiting after consuming expired medicines.

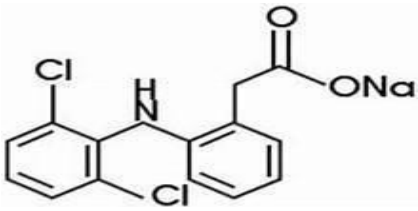
EXPERIMENTAL

The aim of the study is to investigate the fate of few expired formulations with different post expired tenure and to study the observations as per Pharmacoepeial parameters pertaining to stability, quality and efficacy. Like a detailed comparative study between generic and branded formulations[4] the work is so planned by **s**electing 3 expired formulations with different post expired tenure and to conduct to pharmacopeial quality control tests and to collect available literature in this direction of research, compare the outcome with pharmacopeial standards and ultimately discuss the outcomes as per present day literature on expired drugs.

TABLE: 1 DRUGS SELECTED FOR RESEARCH

DRUG NAME AND DOSE	CATEGORY
DICLOFENAC SODIUM IP 50MG	NSAIDS
SODIUM BICARBONATE USP 1000MG	ALKALINIZING AGENT
ESOMEPRAZOLE IP 20MG	PROTON PUMP INHIBITOR

i. DICLOFENAC SODIUM IP 50MG



Chemical structure

Gastro-resistant tablets

1. DICLOFENAC SODIUM 50MG

Diclofenac sodium, the active ingredient in DICLOFENAC SODIUM 50mg, is one of a group of medicines called non-steroidal anti-inflammatory drugs (NSAIDs). NSAIDs reduce pain and inflammation.

DICLOFENAC SODIUM 50mg tablets relieve pain, reduce swelling and ease inflammation in conditions affecting the joints, muscles and tendons including:

- Rheumatoid arthritis, osteoarthritis, acute gout (painful inflammation of the joints especially in the feet and hands), ankylosing spondylitis (form of spinal arthritis).
- Backache, sprains and strains, soft tissue sports injuries, frozen shoulder, dislocations and fractures.
- Conditions affecting the tendons for example, tendonitis, tenosynovitis, bursitis. They are also used to treat pain and inflammation associated with dental and minor surgery.

2. DICLOFENAC SODIUM 50MG IS ADMINISTERED AS

The doctor will tell you how many Diclofenac Sodium 50mg tablets to take and when to take them. Always take this medicine exactly as described in this leaflet or as your doctoror pharmacist has told you. Check with your doctor or pharmacist if you are not sure. Take the tablets with or after food. Swallow the tablets whole with a glass of water. DO NOT crush or chew the tablets.The recommended dose is:

Adults

75 to 150 mg daily in two or three divided doses. The number of tablets which you takewill depend on the strength the doctor has given you.

Elderly

The lowest effective dose should be used. Your doctor may advise you to take a dose that is lower than the usual adult dose if you are elderly. Your doctor may also want to check closely that the Diclofenac Sodium tablets are not affecting your stomach.

children

These tablets are not suitable for children aged under 12.

The doctor may also prescribe another drug to protect the stomach to be taken at the same time, particularly if you have had stomach problems before, or if you are elderly, or taking certain other drugs as well.

3. POSSIBLE SIDE EFFECTS

Like all medicines, Diclofenac Sodium can cause side effects, although not everybody gets him.

Some side effects can be serious

- Sudden and crushing chest pain (signs of myocardial infraction or heart attack)
- Breathlessness, difficulty breathing when lying down, swelling of the feet or legs (signs of heart failure)
- Sudden weakness or numbness in the face, arm or leg especially on one side of the body, sudden loss or disturbance of vision; sudden difficulty in speaking or ability to understand speech; sudden migraine-like headaches which happen for the 1st time, with or without disturbed vision. These symptoms can be an early sign of a stroke.
- Stomach pain, indigestion, heartburn, wind, nausea (feeling sick) or vomiting(being sick)
- Wheezing or shortness of breath (bronchospasm)

If you notice that you are bruising more easily than usual or have frequent sore throats or infections, tell your doctor.

Common side effects (these may affect between 1 and 1 in 10 in every 100 patients):

- Stomach pain, heartburn, nausea, vomiting, diarrhea, indigestion, wind, loss ofappetite, Raised levels of liver enzymes in the blood
- Headache, dizziness, vertigo, Skin rash or spots.

Uncommon side effects (these may affect between 1 and 10 in every 1000 patients):

 Changes in heartbeat, chest pain, heart disorders, heart attack breathlessness

Rare side effects (these may affect between 1 in every 1000 to 1 in every 10000 patients):

 Stomach ulcers or bleeding, Gastritis, Asthma, Cough

- Vomiting blood
- Drowsiness, tiredness, Skin rash and itching
- Liver function disorders, including hepatitis and jaundice

Very rare side effects (these may affect less than 1 in every 10,000 patients):

- Headache, disorientation and loss of memory
- Hypertension
- mouth ulcers
- Facial swelling, skin rashes

Other side effects that have also been reported with unknown frequency include:

Throat disorders, confusion, hallucinations, malaise (general feeling of discomfort), inflammation of the nerves in the eye, disturbance of sensation. Medicines such as diclofenac may be associated with a small increased risk of heart attack or stroke.

4. STORAGE OF DICLOFENAC SODIUM 50MG

Keep out of the sight and reach of children. Do not use diclofenac sodium tablets after the expiry date which is printed after 'Exp' on the carton. Do not store above 25degree Celsius.

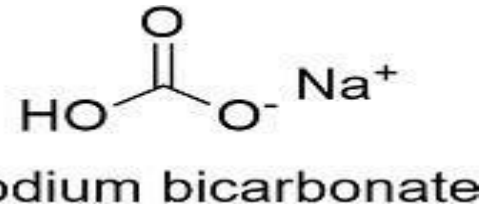
Diclofenac Sodium 50mg tablets contain

DICLOFENAC SODIUM 50 mg: The active substance is diclofenac sodium. Each gastro- resistant tablet contains 50mg of diclofenac sodium. The other ingredients are: tablet core: copolyvidone, microcrystalline cellulose, colloidal anhydrous silica, lactose, maize starch, magnesium stearate, crospovidone. Tablet enteric coat: triethyl citrate, methacrylic acid-ethyl acrylate copolymer (1:1) dispersion 30%, talc. Tablet film coat: hydroxypropyl methylcellulose, polyethylene glycol, iron oxide yellow (E172), iron oxide red (E172), sunset yellow (E110) titanium dioxide (E171). Polish: carnauba wax.

5. CONTENTS AND PACKING OF DICLOFENAC SODIUM 50MG TABLETS

These tablets are marked DICL50 on one side and are reddish-brown in color. Diclofenac sodium 50mg gastro-resistant tablets are packed in cartons containing 28, 84, or 100 tablets in foil blister strips. Not all pack sizes may be marked.

ii. SODIUM BICARBONATE 1000mg



Sodium bicarbonate

Chemical structure

1. SODIUM BICARBONATE 1000mg

Sodium bicarbonate, also known as baking soda, is used to relieve heartburn, sour stomach, or acid indigestion by neutralizing excess stomach acid. When used for this purpose, it is said to belong to the group of medicines called antacids. It may be used to treat the symptoms of stomach or duodenal ulcers. Sodium bicarbonate is also used to make the blood and urine more alkaline in certain conditions.

Antacids should not be given to young children (up to 6 years of age) unless prescribed by their doctor. Since children cannot usually describe their symptoms very well, a doctor should check the child before giving this medicine. Sodium bicarbonate for oral use is available without a prescription.

1. SODIUM BICARBONATE 1000mg IS ADMINISTERED AS

This product is available in the following dosage forms:

- Tablet
- Granule
- Solution

3 POSSIBLE SIDE EFFECTS:

In deciding to use a medicine, the risks of taking the medicine must be weighed against the good it will do. This is a decision you and your doctor will make. For this medicine, the following should be considered:

Allergies

Tell your doctor if you have ever had any unusual or allergic reaction to this medicine or any other medicines. Also tell your health care professional if you have any other types of allergies, such as to foods, dyes, preservatives, or animals. For non- prescription products, read the label or package ingredients carefully.

Pediatric

Antacids should not be given to young children (up to 6 years of age) unless prescribed by a physician. This medicine may not help and may even worsen some conditions, so make sure that your child's problem should be treated with this medicine before you use it.

Geriatric

Many medicines have not been studied specifically in older people. Therefore, it may not be known whether they work exactly the same way they do in younger adults or if they cause different side effects or problems in older people. There is no specific information comparing use of sodium bicarbonate in the elderly with use in other age groups.

Breastfeeding

Studies in women suggest that this medication poses minimal risk to the infant whenused during breastfeeding.

Other Medical Problems

 The presence of other medical problems may affect the use of this medicine. Make sure you tell your doctor if you have any other medical problems, especially:

 Appendicitis or Problems with urination or

 Intestinal or rectal bleeding—Oral forms of sodium bicarbonate may make these conditions worse

 Edema or Kidney disease or Liver disease or

 Heart disease or High blood pressure (hypertension) or

For sodium bicarbonate tablets:

To relieve heartburn or sour stomach:

 Adults and teenagers—325 milligrams (mg) to 2 grams one to four times a day. Children up to 6 years of age—Dose must be determined by your doctor.
 Children 6 to 12 years of age—The dose is 520 mg. The dose may be repeated inthirty minutes.

To make the urine more alkaline (less acidic):

 Adults and teenagers—At first, four grams, then 1 to 2 grams every four hours.

However, the dose is usually not more than 16 grams a day.

 Children—The dose is based on body weight and must be determined by yourdoctor. The usual dose is 23 to 230 mg per

kilogram (kg) (10.5 to 105 mg per pound) of body weight a day. Your doctor maychange the dose if needed.

4. STORAGE OF SODIUM BICARBONATE

Store the medicine in a closed container at room temperature, away from heat, moisture,and direct light, keep from freezing, Keep out of the reach of children.

For patients taking this medicine as an antacid:

- Do not take this medicine if you have any signs of appendicitis (such as stomach or lower abdominal pain, cramping, bloating, soreness, nausea, or vomiting). Instead, check with your doctor as soon as possible.

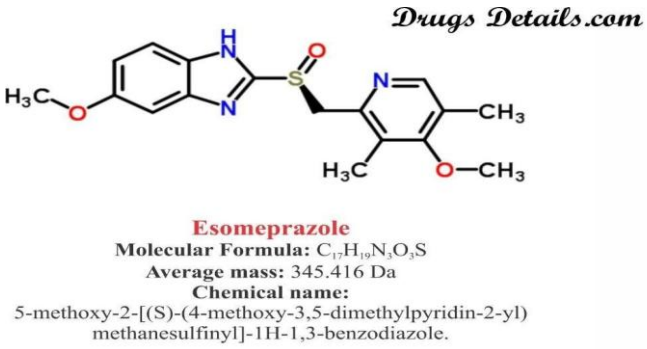
- Do not take this medicine with large amounts of milk or milk products. To do so may increase the chance of side effects.

Side Effects

Along with its needed effects, a medicine may cause some unwanted effects. Although thefollowing side effects occur very rarely when this medicine is taken as recommended, they may be more likely

to occur if it is taken: in large doses, for a long time, or by patients with kidney disease.

iii. ESOMEPRAZOLE TABLETS IP 20mg



Esomeprazole
Molecular Formula: $C_{17}H_{19}N_3O_3S$
Average mass: 345.416 Da
Chemical name:
5-methoxy-2-[(S)-(4-methoxy-3,5-dimethylpyridin-2-yl) methanesulfinyl]-1H-1,3-benzodiazole.

1. ESOMEPRAZOLE TABLETS IP 20mg

Esomeprazole is used to treat conditions where there is too much acid in the stomach. It is used to treat duodenal and gastric ulcers, erosive esophagitis, gastroesophageal reflux

disease (GERD), and Zollinger- Ellison syndrome, a condition wherein the stomach produces too much acid. Esomeprazole is also used with antibiotics (e.g.: amoxicillin, clarithromycin) to treat ulcers that are caused by the H. pylori bacteria. This medicine is also used to prevent stomach ulcers and stomach irritation in patients taking NSAIDs (e.g.: aspirin, ibuprofen) for long periods of time. Esomeprazole is a proton pump inhibitor (PPI). It works by decreasing the amount of acid that is produced by the stomach.

2. ESOMEPRAZOLE CAN BE ADMINISTERED AS

This medicine is available both over-the-counter (OTC) and with your doctor's prescription.
This product is available in the following dosage forms:

- Capsule, Delayed Release
- Packet
- Tablet, Delayed Release

3. POSSIBLE SIDE EFFECTS

In deciding to use a medicine, the risks of taking the medicine must be weighed against the good it will do. This is a decision you and your doctor will make. For this medicine, the following should be considered: **Allergies**

Tell your doctor if you have ever had any unusual or allergic reaction to this medicine or any other medicines. Also tell your health care professional if you have any other types of allergies, such as to foods, dyes, preservatives, or animals. For non- prescription products, read the label or package ingredients carefully.

Pediatric

Appropriate studies performed to date have not demonstrated pediatric- specific problems that would limit the usefulness of esomeprazole for GERD in children. However, safety and efficacy have not been established for children younger than 1 month of age.

Geriatric

Appropriate studies performed to date have not demonstrated geriatric- specific problems that would limit the usefulness of esomeprazole in the elderly. However, elderly patients are more sensitive to the effects of this medicine than younger adults.

Breastfeeding

There are no adequate studies in women for determining infant risk when using this medication during breastfeeding. Weigh the potential benefits against the potential risks before taking this medication while breastfeeding.

Dosing

The dose of this medicine will be different for different patients. Follow your doctor's orders or the directions on the label. The following information includes only the average doses of this medicine.

For oral dosage forms:

- To prevent NSAID-associated gastric ulcer:
  - Adults—20 or 40 milligrams (mg) once a day for up to 6 months. Your doctor may adjust your dose if as needed.
  - Children—Use and dose must be determined by your doctor.
- To treat duodenal ulcers with H. pylori infection:
  - Adults—40 milligrams (mg) once a day for 10 days. The dose is usually taken together with amoxicillin and clarithromycin. Your doctor may adjust your dose as needed.
  - Children—Use and dose must be determined by your doctor.
- To treat heartburn:
  - Adults—20 milligrams (mg) once a day for 14 days.
  - Children—Use and dose must be determined by your doctor.

4. STORAGE OF ESOMEPRAZOLE

- Store the medicine in a closed container at room temperature, away from heat,moisture, and direct light. Keep from freezing.
- Keep out of the reach of children.
- Do not keep outdated medicine or medicine no longer needed.
- Ask your healthcare professional how you should dispose of any medicine you donot use.

Some side effects may occur that usually do not need medical attention. These side effects may go away during treatment as your body adjusts to the medicine. Also, your health care professional may be able to tell you about ways to prevent or reduce some of these side effects. Check with your health care professional if any of the following side effects continue or are bothersome or if you have any questions about them:

MATERIAL AND METHODS:

1. PHYSICAL EVALUATION
2. THICKNESS
3. HARDNESS
4. FRIABILITY
5. ASSAY
6. DISINTEGRATION TEST
7. DISSOLUTION TEST
8. ABSORPTION MAXIMA.

Depending upon the results obtained, quality of the formulation can be defined.

Physical Evaluation

Colour: Colour of the tablet was recorded. **Odour**:

odour of the tablet was recorded. **Thickness**

Tablet thickness is a key quality control test. Very thick tablet can affect packaging either in blister or a plastic container. Tablet thickness is determined by the measurement of the uniform diameter of the tablet.

Hardness

The test measures a property of the tablet called CRUSHING STRENGTH which is defined as the compressional force applied diametrically to a tablet that just fractures it. Hardness tester (Cobb's) is among the most favoured measuring devices. This is manually used. Some hardness testers are motor driven.

Friability

The tablet may undergo a tumbling motion. Coating, packaging, transport may not be severe enough to break the tablet. Therefore, tablets are subjected to a uniform tumbling motion for a specified time and weight loss is assessed.

Disintegration Test

The breakage of tablet into smaller fragments is called disintegration of tablet.

The USP device uses 6 glass tubes that are 3" long; open at

the top and 10 mesh screens at the bottom end. To assess disintegration time, one tablet is placed in each tube and the basket rack is positioned in a 1-L beaker of water, simulated gastric fluid or simulated intestinal fluid at 37 ± 20°C such that the tablet is 2.5 cm below the surface of liquid on their upward movement and not closer than 2.5 cm from the bottom of the beaker in their downward movement. The basket containing the tablets is moved up and down through a distance of 5-6 cm at a frequency of 28-32 cycles per minute. Floating of the tablets is prevented by placing perforated plastic discs on each tablet.

Disintegration time: Uncoated tablet: 5-30 minutes. Coated tablet: 1-2 hours.

Dissolution Test

The release of drug from the tablet into solution per unit time under standardized condition is termed as the dissolution test. Basket Type: A single tablet is placed in a small wire mesh basket attached to the bottom of the shaft which is connected to a variable speed motor. The basket is immersed in a dissolution medium contained in a 1,000 mL flask. The flask is cylindrical with a hemispherical bottom. The flask is maintained at 37°C (±0.5) by a constant temperature bath.

Absorption Maxima

In order to select analytical wavelength, 2.5 µg/mL of the selected drug is prepared by appropriate dilution of standard stock solution and subjected to scanning in the spectrum mode from 400 nm to 200 nm. From the scanned spectra, suitable Absorption maxima [Lambda Max] of the drug is selected for the analysis. The calibration curve is prepared in the concentration in the suitable range of 0.1-4 µg/mL at suitable wavelength (nm). By using the calibration curve, the concentration of the sample solution can be determined.

Table 1. Drugs Selected for Research

Drug name and dose	Category
DICLOFENAC SODIUM 50MG	ANTI-INFLAMMATORY DRUG
SODIUM BICARBONATE 1000MG	ANTACID
ESOMEPRAZOLE 20MG	PROTON PUMP INHIBITORS

Table 2. Drugs Selected

Pure Drug	Batch number	Mfg. Date	Expiry date	Conduction of research	Length of expiry	Company name
Diclofenac						

sodium50mg (Enteric coated tablet)	**313MBBF0**	03/2020	02/2022	05/2022	02 months	The names of the companieswere kept confidential to protect the integrity
Sodium bicarbonate 1000mg (Film coated tablet)	**T- 1910118**	10/2019	09/2021	05/2022	08 months	
Esomeprazole 20mg (Enteric coated tablet)	**1B200038**	01/2020	12/2021	05/2022	05 months	

RESULTS AND DISCUSSION

A lot of research had been carried out on drugs for many parameters pertaining to stability, quality, efficacy. Research on expired formulations is ignored and data on fate of expired drugs is scanty. An attempt was made in this line to find out the stability, quality and efficacy of three expired drugs and trialed

Expired formulations of Diclofenac sodium, sodium bicarbonate, and esomeprazole were selected. The expiry ranges between 2-8 months. The names of the Company and formulations were kept confidential to protect integrity Routine quality control tests were conducted as per their concerned Pharmacopeias surprisingly the standards of stability and efficacy not much deviated the observation of recorded parameters are as follows

Observation of diclofenac sodium

1. Diclofenac sodium is of 50mg tablets expired 2months back.
2. There is no change in color, it remains as iron oxide red.
3. Thickness also remains even.
4. Hardness test of the tablet was dragged up to 10kg/ cm2 which is The IRlimit.
5. Friability test indicated 0.2%, weight loss which is less Than lowernormal
6. Assay is 92.57%, which is not a disappointing one
7. Disintegration time was 70min which is moderate but not disastrous

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8. Drug release is 90.15%. during dissolution test which is border of lowerlimit.

Table. Quality Parameters of Expiry drug of Diclofenac gastro- resistant tablet

Parameters	**Result of Expirydrug**	**Inference**
Drug name	Diclofenac sodium	NSAID
Trade name	Confidential	--
Company name	Company name is kept confidential	--
Drug quantity(mg)	50mg	Routine single dose Expired 2 months back.
Physical evaluation ColorOdor	Iron oxide yellowNone	No color deflectionNo odor
Thickness(mm) No defined standards	3.7 mm	Even through out
Hardness (4-10 kg/cm**2**)	10	At higher boarder
Friability (NMT 0.5-1% weight loss)	0.2%	Less than lower limit
Assay (90-110% purity)	92.57%	Moderately good value
Disintegration time (15min in water with 37°C)	70 min	Moderately high value
Dissolution test (95-105% of drug release)	90.15%	Not disappointing value
Determination of absorption maxima	276.20nm	Standard Value.

Result:

The above quality control Parameters indicates that the formulation is still alivewhen tested as per the standard Pharmacopeial procedures.

Observations of sodium bicarbonate

1. Sodium bicarbonate is 1000ng tablet and expired 8months back.
2. The color of this tablet remains same as titanium dioxide, when comparedwith unexpired tablet
3. Thickness remained even
4. Hardness of the tablet is sufficiently within the limit 12.3 kg/cm2
5. The limit of 0.385% is weight loss during friability test which is excellentindicating lesser than the lower limit.

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6. Assay showed 86.442%, which is moderately lesser than lower normal, but as the content of tablet is 1000mg loss of 13% purity, though not admissible is a good Stability for an 8th month expired formulation

7. Disintegration time is 3.16min and it's a good value.

8. Dissolution test gives 83.13%. of drug release which is not discouraging. Table 4. Quality Parameters of Expiry drug of sodium bicarbonate tablet

Parameters	**Result of Expiry drug**	**Inference**
Drug name	Sodium bicarbonate	Alkalinizing agent
Trade name	Confidential	--
Company name	Company name is kept confidential	--
Drug quantity(mg)	1000mg	Routine single dose
Physical evaluation Color Odor	Titanium oxideNone	No color deflectionNo odor
Thickness(mm) No defined standards	2.4mm	Even through out
Hardness (4-10 kg/cm**2**)	12.3	Within the limit
Friability (NMT 0.5-1% weight loss)	0.385%	Lesser than the lower limit
Assay (90-110% purity)	86.442%	Lesser than the lower limit
Disintegration time (15min in water with 37°C)	3.16 min	Good value
Dissolution test (95-105% of drug release)	83.13%	Low but not a discouraging value.
Determination of absorption maxima	289nm	Standard value.

Result:

The above quality control Parameters indicates that the formulation is still alivewhen tested as per the standard Pharmacoepeial procedures.

Observations of Esomeprazole

1. Esomeprazole is of 20mg of tablet and expired 5 months back.

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2. There is no change in color it remains ferric oxide red.
3. Thickness also remains even.
4. Hardness of tablet is 7.5 kg/cm2 which is comfortably within normal.
5. Friability indicated 2. 38 % weight is loss which isa bit more than thenormal bit.
6. Assay is 98.7% which is an excellent output
7. Disintegration time was 65 min which is a bit more than the higher

limit.

8. Drug release is 95.8% during dissolution test which is moderately good value for a 5months expired drug

Table 5. Quality Parameters of Expiry drug of Esomeprazole tablet

Parameters	**Result of Expiry drug**	**Inference**
Drug name	Esomeprazole magnesium trihydrate	Proton pump inhibitor
Trade name	Confidential	--
Company name	Company name is kept confidential	--
Drug quantity(mg)	20mg	Routine single dose
Physical evaluation Color Odor	Ferric oxide redNone	No color deflection
Thickness (mm) No defined standards	3.4mm	Even through out
Hardness (4-10 kg/cm2)	7.5	Within the limits
Friability (NMT 0.5-1% weight loss)	2.38%	Moderate loss of weight
Assay (90-110% purity)	98.7%	Excellent output
Disintegration time (15min in water with 37°C)	65min	High value due to high friability.

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Dissolution time ` (95-105% of drug release)	95.8%	Moderately good value
Determination of absorption maxima	275nm	Standard Value.

Result:

The above quality control Parameters indicates that the formulation is still alive when tested as per the standard Pharmacopeial procedures.

SUMMARY & CONCLUSION

While summarizing the results and the outcome it was clearly evident that the trialed 3expired drugs are still alive in terms of Stability, quality and efficacy.
The notion that Consuming expired drugs in hazardous and life threatening is absolutely in evident and Unproven Common Public were misled with this kind of statements in the entertainment and in the media a channel. The fact we found in this attempt is that, the expired formulations are meeker in stability, quality and efficacy after expiry. However, as Pharmacist we strongly discourage usage of expired drugs and abandon their existence.
It was concluded that expired drugs are just inferior in standards and specifically may not meet the Pharmacopeial requirement. This study has thrown light on unboxed concept of expired drugs where no importance was given in research. The same situation is anticipated with other drugs too. The aim of the work for investigating the fate of expired formulations is here with accomplished.

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