EVALUATION OF pH OF THE RECONSTITUTED AMOXICILLIN DRY SYRUP/SUSPENSION AND ITS SENSITIVITY (AGAINST *Escherichia coli)* FROM DIFFERENT BRANDED PRODUCTS IN BANGLADESH

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A Research paper submitted to the Department of Pharmacy, East West University in conformity with the requirements for the degree of Bachelor of Pharmacy.

CERTIFICATE

This is to certify that the thesis paper on "**EVALUATION OF pH OF THE RECONSTITUTED AMOXICILLIN DRY SYRUP/SUSPENSION AND ITS SENSITIVITY (AGAINST *Escherichia coli)* FROM DIFFERENT BRANDED PRODUCTS IN BANGLADESH**" submitted to the Department of Pharmacy, East West University, Mohakhali, Dhaka, in partial fulfillment of the requirements for the degree of Bachelor of Pharmacy (B.PHRM) was carried out by Risalat Binte Hossain (ID: 2005-2-70-064) under our guidance and supervision and that no part of the thesis has been submitted for any other degree. We further certify that all the sources of information and laboratory facilities availed of this connection is duly acknowledged.

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ABSTRACT

Amoxicillin belongs to a class of antibiotics called penicillin. An amino-penicillin, amoxicillin is commercially available as the trihydrate. Amoxicillin is a broad spectrum antibiotic which is active against both gram positive and gram negative bacteria such as *Escherichia coli (E.coli).*

The objective of this study was to test the pH profile and sensitivity of amoxicillin dry syrup/suspension.

The study was performed with different brands of amoxicillin dry syrup/suspension of 16 different pharmaceutical companies of Bangladesh. Syrups/suspensions were randomly selected from big, medium and small pharmaceutical companies of Bangladesh. The pharmaceutical companies were categorized according to the market size that has been reported to the IMS data. The reconstituted syrup/suspension must contain an optimum pH to remain stable. So to check that, pH values of reconstituted syrup/suspension were measured with the help of a pH meter. In addition to that sensitivity of reconstituted syrup/suspension was determined by performing Disk-Diffusion method. In this method the zone of inhibition of antibiotic against *Escherichia coli* (*E.coli*) was determined.

The pH of amoxicillin syrup/suspension of 6 big, 2 medium and 5 small pharmaceutical companies is within the range that complies with the Pharmacopoeia. The zone of inhibition showed by reconstituted syrup/suspension of 7 Big, 4 Medium and 4 Small pharmaceutical companies is within the acceptable range.

Most of the syrup/suspension showed better stability by maintaining a pH value within the range (4.0-7.0) **(British Pharmacopoeia, 2004).** Syrup/suspension from big, medium and small pharmaceutical companies showed acceptable zone of inhibition against *E.coli* bacterial strain.

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CHAPTER 01

INTRODUCTION

1.1 INTRODUCTION:

All antibiotics that are in clinical use in the industrialized world are found in Bangladesh. Government policy in general is liberal with antibiotic import, admittedly because the need is great due to a high prevalence of infectious diseases and heavy germ load in the environment. Rational use of antibiotics is a serious issue in the context of Bangladesh. Bacteria are so well armored that frequently they develop an array of biochemical mechanisms by which they can resist the antibiotic. Thus, the greater an antibiotic is in use the faster will be the development of resistance. With its 130 million people and a very heavy infectious disease load, in Bangladesh huge quantities of antibiotics are used annually. But a very large portion of this is used unfortunately under conditions of inadequate or no medical supervision and in most cases without prior tests on identification of the disease-causing organism and determination of its sensitivity to the antibiotic prescribed. The sale of antibiotics without proper medical prescription or on a quack 'prescription' or simply on verbal demand of the buyer is common both in cities and rural areas. Even in those cases where a qualified doctor prescribes an antibiotic, patient compliance regarding using the full course of the drug is not always satisfactory largely due to ignorance. In such cases if the patient gets an unstable product that will contribute in worsening the present condition. This pH profile testing and sensitivity testing will help us to detect those unseen problems which may affect the human beings and help us to do something for the mankind. **(Zia Uddin Ahmed, Banglapedia)**

In Bangladesh Pharmaceutical sector is one of the most developed hi tech sector which is contributing in the country's economy. Due to recent development of this sector we are exporting medicines to global market including European market. This sector is also providing 95% of the total medicine requirement of the local market. Antibiotic market is one of the major parts of this pharmaceutical market. Amoxicillin is a common penicillin class of antibiotic which is used for the treatment of different kinds of common infections. So to show proper therapeutic action the compound should maintain an optimum pH and sensitivity. Amoxicillin dry syrup/suspension is considered to be a formulation having both proper pH profile and sensitivity. But according to our knowledge there is no current study performed to determine the pH of reconstituted

amoxicillin dry syrup/suspension. So to get an idea about the pH profile and at the same time sensitivity of amoxicillin dry syrup/suspension, this study was carried out with different brands of amoxicillin dry syrup/suspension of some pharmaceutical companies of Bangladesh.

1.2 ANTIBIOTICS: Antibiotics (Greek *anti,* "against"; *bios,* "life") are the greatest contribution of the 20th century to therapeutics. These are substances which may be natural (produced naturally by microorganisms) or synthetic and suppress the growth or kill the microorganisms at very low concentration. **(Tripathi, KD.2003)**

1.2.1CLASSIFICATION OF ANTIBIOTICS:

Antimicrobials are classified in many ways. Such as:

A. According to Chemical structure:

1) β-Lactam antibiotics. Such as
   - I. Penicillins.
   - II. Cephalosporins.
   - III. Carbapenems.
   - IV. Monobactams.
2) Tetracyclines:
   - I. Oxytetracycline,
   - II. Doxycycline
   - III. Chlortetracycline etc.
3) Aminoglycosides:
   - I. Streptomycin
   - II. Gentamycin
   - III. Neomycin etc.
4) Macrolides:
   - I. Erythromycin
   - II. Roxithromycin
   - III. Azithromycin etc.

5) Nitrobenzene derivative: Chloramphenicol.

6) Sulfonamides and related drugs:

   I. Sulfadiazine

   II. Sulfamethoxazole

   III. Sulfadoxine etc.

7) Diaminopyrimidines:

   I. Trimethoprim

   II. Pyrimethamine.

8) Quinolones & Fluroquinolones:

   I. Nalidixic acid.

   II. Ciprofloxacin.

   III. Norfloxacin etc.

9) Nitroimidazole:

   I. Metroimidazole

   II. Tinidazole.

10) Polypeptide antibiotics:

   I. Polymyxin-B

   II. Bacitracin.

   III. Tyrothricin etc.

11) Others: Rifampicin, Clindamycin, Viomycin, Griseofulvin etc.

B. According to Mechanism of Action:

1) Inhibitors of cell wall synthesis

   I. β-Lactam antibiotics (e.g Penicillin, Cephalosporin)

   I. Vancomycin

   II. Bacitracin

2) Inhibitors of protein synthesis

   I. Tetracyclines

   II. Macrolides

   III. Clindamycin

   IV. Chloramphenicol

3) Interfere with intermediary metabolism:
    I. Sulfonamides
    II. Trimethoprim
    III. Pyrimethamine
4) Inhibitors of nucleic acid function or synthesis
    I. Quinolones & Fluroquinolones
    II. Rifampicin
5) β-Lactamase inhibitors
    I. Clavulanic acid
    II. Sulbactam
    III. Tazobactam
6) Cause misreading of m-RNA codes and affect permeability:
    I. Aminoglycosides.

C. **According to type of microorganisms against which primarily active:**

1) Antibacterial drugs: Penicillin, Chloramphenicol, Aminoglycosides.
2) Antiviral drugs: Acyclovir, Zidovudine, Amantadine.
3) Antifungal drugs: Griseofulvin, Ketoconazole, Amphotericin-B.
4) Antiprotozoal drugs: Metronidazole, Chlotoquine.
5) Anthelmintics: Mebendazole, Pyrantel, Niclosamide.

D. **According to Type of Action:**

1) Primarily Bacteriostatic: Tetracyclines, Chloramphenicol, Sulfonamides.
2) Primarily Bactericidal: Penicillin, Cephalosporin, Aminoglycosides.

(Tripathi KD, 2003)

1.2.2 DESCRIPTION OF SOME IMPORTANT CLASSES OF ANTIBIOTICS:

The main classes of antibiotics are as follows

- Aminoglycosides
- Cephalosporins
- Fluoroquinolones

- Macrolides
- Penicillins
- Tetracyclines

❖ **Macrolides:** Macrolides are composed of 14 (erythromycin and clarithromycin)-, 15 (azithromycin)-, or 16 (josamycin, spiramycin, and tylosin)-membered lactones to which are attached amino and/or neutral sugars via glycosidic bonds. Erythromycin was introduced in 1952 as the first macrolide antibiotic. Unfortunately, within a year, erythromycin-resistant (Em^r) staphylococci from the United States, Europe, and Japan were described. Erythromycin is produced by *Saccharopolyspora erythraea*, while the newer macrolides are semisynthetic molecules with substitutions on the lactone. The newer derivatives, such as clarithromycin and azithromycin, have improved intracellular and tissue penetration, are more stable, are better absorbed, have a lower incidence of gastrointestinal side effects, and are less likely to interact with other drugs. They are useable against a wider range of infectious bacteria, such as *Legionella*, *Chlamydia*, *Haemophilus*, and some *Mycobacterium* species (not *M. tuberculosis*), and their pharmacokinetics provide for less frequent dosing than erythromycin. As a result, the usage of the newer macrolides has increased dramatically over the last few years, which has led to increased exposure of bacterial populations to macrolides. (**Marilyn C. Roberts et al, 1999)**

❖ **Aminoglycosides:**

Aminoglycoside antibiotics are used to treat infections caused by gram-negative bacteria. Aminoglycosides may be used along with penicillins or cephalosporins to give a two-pronged attack on the bacteria. Aminoglycosides work quite well, but bacteria can become resistant to them. Since aminoglycosides are broken down easily in the stomach, they can't be given by mouth and must be injected. When injected, their side effects include possible damage to the ears and to the kidneys. This can be minimized by checking the amount of the drug in the blood and adjusting the dose so that there is enough drug to kill bacteria but not too much of it. Generally, aminoglycosides are given for short time periods. **(Bayarski, Y.2006)**

The aminoglycosides are drugs which stop bacteria from making proteins. This effect is called bactericidal. The most commonly-prescribed aminoglycosides:

- amikacin
- gentamicin
- kanamycin
- neomycin
- streptomycin
- tobramycin

❖ **Cephalosporins**

Cephalosporins are grouped into "generations" by their antimicrobial properties. Cephalosporins are categorized chronically, and are therefore divided into first, second, and third generations. Currently, three generations of cephalosporins are recognized and a fourth has been proposed. Each newer generation of cephalosporins has greater gram negative antimicrobial properties than the preceding generation. The later-generation cephalosporins have greater effect against resistant bacteria.

Cephalosporins are used to treat pneumonia, strep throat, staph infections, tonsillitis, bronchitis, otitis media, various types of skin infections, gonorrhea. Cephalosporin antibiotics are also commonly used for surgical prophylaxis. Cephalosporins are closely related to the penicillins.

Cephalosporins have a bacteriocidal effect by inhibiting the synthesis of the bacteria cell wall.The most commonly-prescribed cephalosporins:

- **First generation**
  - cephazolin
  - cefadroxil
  - cephalexin
  - cephradine
  -

- **Second generation**
    - cefaclor
    - cefuroxime
    - cefprozil
    - loracarbef
- **Third generation**
    - cefotaxime
    - cefixime
    - cefpodoxime
    - ceftazidime
    - cefdinir
- **Fourth generation**
    - cefepime
    - cefpirome

❖ **Fluoroquinolones:**

Fluoroquinolones are known as broad-spectrum antibiotics, meaning they are effective against many bacteria. Fluoroquinolones are used to treat most common urinary tract infections, skin infections, and respiratory infections (such as sinusitis, pneumonia, bronchitis). Common side effects of fluoroquinolones include mainly the digestive system: mild stomach pain or upset, nausea, vomiting, and diarrhea. These are usually mild and go away over time. Fluoroquinolones should not be given during pregnancy.

Fluoroquinolones inhibit bacteria by interfering with their ability to make DNA. This activity makes it difficult for bacteria to multiply. This effect is bactericidal.

The most commonly-prescribed fluoroquinolones:

- ciprofloxacin
- gatifloxacin
- gemifloxacin
- levofloxacin

- moxifloxacin
- norfloxacin
- ofloxacin
- trovafloxacin

❖ **Penicillins:**

Penicillin was the first antibiotic discovered by Alexander Fleming in 1929. Penicillins are used to treat skin infections, dental infections, ear infections, respiratory tract infections, urinary tract infections, gonorrhea. Penicillins are sometimes combined with other ingredients called beta-lactamase inhibitors, which protect the penicillin from bacterial enzymes that may destroy it before it can do its work.

Penicillins are usually very safe. The greatest risk is an allergic reaction, which can be severe. People who have been allergic to cephalosporins are likely to be allergic to penicillins.

Penicillins block the construction of bacteria cell walls, causing the walls to break down, and eventually killing the bacteria.

The most commonly-prescribed penicillins:

- amoxicillin
- ampicillin
- bacampicillin
- oxacillin
- penicillin

❖ **Tetracyclines:** Tetracyclines are a family of antibiotics used to treat a broad spectrum of bacterial infections. Tetracyclines were discovered in the late 1940s and were extremely popular when they were first discovered. The tetracycline antibiotics have a very broad spectrum of action.

Tetracyclines are used to treat mild acne, Rocky Mountain spotted fever, Lyme disease, upper respiratory tract infections, urinary tract infections, sexually transmitted diseases, typhus.

The most commonly-prescribed tetracyclines:

- tetracycline
- doxycycline
- Minocycline

(Bayarski, Y.2006)

1.2.3 RESISTANCE TO ANTIBIOTICS:

1.2.3.1 INTRINSIC RESISTANCE:

Some bacteria are intrinsically resistant to certain of the antibiotics. Example: Gram-positive bacteria are much less susceptible to polymyxins than Gram-negative bacteria. [The "Gram" designations refer to the behavior of the bacteria when stained with the Gram stain; this behavior is a reflection of the very different organization of their cell walls.]

1.2.3.2 ACQUIRED RESISTANCE:

Many bacteria acquire resistance to one or more of the antibiotics to which they were formerly susceptible.

Bacteria develop resistance by acquiring genes encoding proteins that protect them from the effects of the antibiotic. In some cases the genes arise by mutation; in others, they are acquired from other bacteria that are already resistant to the antibiotic. The genes are often found on plasmids which spread easily from one bacterium to another — even from one species of bacterium to another.

Examples:

Synthesis of the enzyme penicillinase — or other beta-lactamases — provides protection from the beta-lactam antibiotics. These enzymes break the beta-lactam ring at the position shown with the green arrow in the diagram of penicillin G.

- Likewise synthesis of cephalosporinases defeats the cephalosporins.
- Defeating quinolones:
    - Some bacteria do this by modifying their DNA gyrase.
    - Others, e.g., Mycobacterium tuberculosis, develop quinolone resistance by synthesizing a protein that resembles a short length of DNA. This protein binds the gyrase so it cannot form the DNA/gyrase complex that is the target of quinolone action.
- Some bacteria synthesize "pumps" in their plasma membrane through which they remove antibiotics like tetracyclines from the interior of the cell.
- Bacteria may methylate their ribosomes obscuring the target of antibiotics (e.g., erythromycin) that ordinarily bind to and inactivate the ribosome — or conversely
- They may enzymatically modify the antibiotic (e.g., kanamycin) so it can no longer "see" its ribosomal target.
- Bacteria may modify the structure of their peptidoglycan wall and thus avoid the inhibitory effects of antibiotics like cycloserine.

An alarming number of human pathogens have acquired genes to combat all the presently-used antibiotics except vancomycin and recently vancomycin-resistant bacteria have appeared. These multidrug-resistant strains are particularly common in hospitals where antibiotic use is heavy, and the patients often have weakened immune systems. **(Tripathi, KD.2003)**

1.2.4 SIDE EFFECTS OF ANTIBIOTICS:

Antibiotics can literally save lives and are effective in treating illnesses caused by bacterial infections. However, like all drugs, they have the potential to cause unwanted

side effects. Many of these side effects are not dangerous, although they can make life miserable while the drug is being taken.

In general, antibiotics rarely cause serious side effects. The most common side effects from antibiotics are diarrhea, nausea, vomiting. Fungal infections of the mouth, digestive tract and vagina can also occur with antibiotics because they destroy the protective 'good' bacteria in the body (which help prevent overgrowth of any one organism), as well as the 'bad' ones, responsible for the infection being treated.

Some people are allergic to antibiotics, particularly penicillins. Allergic reactions cause swelling of the face, itching and a skin rash and, in severe cases, breathing difficulties. Allergic reactions require prompt treatment. **(Bayarski, Y.2006)**

1.3 PHARMACEUTICAL DRY SYRUP:

Pharmaceutical dry syrup is a mixture of finely divided drugs and/or chemicals on dry form at the initial stage. Before it is taken by patients, it is converted to liquid form by adding sterile liquid with the solid form. The solid powder forms are available in crystalline and amorphous form. The particle size plays an important role in physical, chemical and biological properties of the dosage form. There is a relationship between particle size of solid particles and the proportion of liquid with dissolution, absorption and therapeutic efficacy of drugs. Several dry syrup formulations have been developed for antibiotics which are generally unstable in water. Amoxicillin dry syrup is one of those formulations.

Dry syrups mean syrups to be dissolved or suspended before use. Dry syrups to be dissolved in water mean those which become clear and leave no trace of precipitated ingredients when mixed with an appropriate amount of water. **(Masaaki Nomura, 2003)** Antibiotics may be topical—applied to the surface of the skin, eye, or ear in the form of ointments or creams. They may be oral—given by mouth, and either allowed to dissolve in the mouth or be swallowed, in which case they are absorbed into the bloodstream through the intestines. Antibiotics may also be parenteral—injected intramuscularly, intravenously, or subcutaneously; antibiotics are administered parenterally when fast

absorption is required. But most stable dosage form is thought to be the dry syrup or suspension form. **(Prous et al, 1993)**

1.3.1 ADVANTAGES OF DRY SYRUP/SUSPENSION:

As it is in solid form at initial stage, it is much more stable than the liquid dosage form.

1. Extended shelf-life than the liquid dosage form.
2. The chances of incompatibility are less as compared to liquid dosage form.
3. Less chance of microbial contamination until unless the container is opened and mixed with liquid.

1.3.2 DISADVANTAGES OF DRY SYRUP/SUSPENSION:

1. Drugs having bitter, nauseous and unpleasant taste cannot be dispensed in this form.
2. Deliquescent and hygroscopic drugs cannot be dispensed in this form.
3. Drugs which get affected by atmospheric conditions are not suitable for dispensing in dry syrup form.

1.4 STABILITY OF RECONSTITUTED PRODUCTS:

Shelf life refers to the period from initial preparation and packaging up to expiry date during which the drug dosage form continues to remain within its physical, chemical, and toxicological specifications at specified storage conditions. **(Aulton, E. Michael, 2002)**. The product must retain the labeled claim within the limit mentioned for specified products under drug act and related Pharmacopoeia. Drug products that require reconstitution prior to dispensing to the patient or the consumer requires special consideration with regard to stability testing. For reconstituted products 2 distinct stability periods are in operation. The first period covers up to its expiry date and the second period consists of usually short term stability after reconstitution. Stability study after reconstitution as directed on the label should be conducted by appropriate sampling testing to cover a period beyond that specified on the label. **(C. T Rhodes et al, 2009)**

1.5 STABILITY FACTORS OF ANTIBIOTIC (PENICILLIN) DRY SYRUP/SUSPENSION:

β-lactam antibiotics are widely used in the treatment of all kinds of bacterial infections. Representatives of the different groups (penicillins, cephalosporins etc.) of the said antibiotics have shown to be active or oral administration. Although an anhydrous form, hydrates, solvates, salts and esters of the β-lactam antibiotics have been prepared, large differences in stability between the various forms of those antibiotics have been observed. For this reason flucloxacillin is commercially available only as the sodium salt, the anhydrous form of ampicillin is most preferred and the form of amoxicillin currently in use if the trihydrate. On the other hand other β-lactam antibiotics have appeared to be stable in more than one form: e.g. phenoxymethylpenicillin is commercially available as the free acid, as various salts (calcium, sodium, potassium) and as an ester. However, on oral administration only the potassium salt has shown the best bioavailability. A person, who has to prepare a pharmaceutical dosage-form, containing a β-lactam antibiotic, thus cannot always avail of that chemical form, which he would prefer in view of solubility and organoleptic properties. **(Van Koutrik, et al 1999)**

Stability testing of an active substance or finished product provides information of the variation of drug substance or final product with time influenced by a variety of environmental factors such as temperature, humidity and light. Knowledge gained from stability studies enables understanding of the effects of environment on the drug.

A. Dry Salts: The dry salts are very stable. Provided they contain less than 1 percent of moisture their potency is retained for many years at room temperature. Therefore, they must be packed in moisture proof containers.

B. Aqueous solutions: Rapid hydrolysis occurs in aqueous solutions. This opens the β-lactam ring of the molecule to produce dibasic penicilloic acid.

Consequently-

a. Solutions have a very short life even when refrigerated. Unbuffered injections, kept at 2 to 10°C, must be used within 7 days.

b. Sterilisation by filtration is impracticable.

The stability of solutions is influenced by-

1. Temperature: The hydrolysis rate increases with rise of temperature.

a. Heat sterilization of solutions is impossible.

b. Low temperature storage is advisable.

2. pH: Optimum stability is shown within the pH range 6 to 6.5. Because the hydrolysis products are more acid than penicillin the pH falls, with consequent increase in the rate of destruction and further drop in pH; this continues until all the penicillin is destroyed. Loss of activity can be significantly reduced by adding a buffer to maintain the pH between 6 and 7.

3. Concentration: Concentrated solutions deteriorate most rapidly, presumably because the pH fall due to hydrolysis is greater than in weaker solutions. At 4°C the concentrated solutions showed no loss of potency in 8 days.

4. Penicillinase: Penicillinase destroys penicillin by hydrolysis. The optimum pH for penicillin stability and penicillinase activity are approximately the same and therefore, pH adjustment cannot be used to inhibit the enzyme. Its activity in penicillin preparations is prevented by-

a. Issuing a sterile product and/or

b. Including a bactericide.

c. Refrigeration (injection) or storage in a cool place (other preparation)

5. Traces of Heavy Metals: Traces of copper, lead, mercury and possibly other heavy metal icons catalyse the breakdown of the sulphur-containing ring in penicillin. **(Carter, S.J. 1987)**

1.6 SENSITIVITY OF ANTIBIOTICS:

The Sensitivity of an antibiotic can be measured by using disc diffusion method to determine the sensitivity of an antibiotic against specific micro-organism. **(Walker MG, Hoffman BF, Curtis M, 2006)**.

Zone of Inhibition test is a common method to test the sensitivity of antibiotics but it has some limitations. Such as:

- Zone of Inhibition tests do not necessarily indicate that microorganisms have been killed by an antimicrobial product - just that they have been prevented from growing.
- Microbial growth agars themselves may interfere with the function of some antimicrobial agents.
- The method cannot be used to test the activity of antimicrobial agents against viruses, since viruses don't "grow" on agar plates like bacteria (viruses don't replicate outside of their host organisms).
- The method has some natural variability, and zones of microbial inhibition do not always have clear or regular boundaries.

The method is not classically quantitative though sometimes the diameter of the zones of inhibition are measured and recorded.

CHAPTER 02

AMOXICILLIN

2. AMOXICILLIN:

Amoxicillin is a broad-spectrum, β-lactam antibiotic used to treat bacterial infections caused by susceptible microorganisms. It is usually the drug of choice within the class because it is better absorbed, following oral administration, than other β-lactam antibiotics.

2.1 MECHANISM OF ACTION OF AMOXICILLIN: Amoxicillin acts by inhibiting the synthesis of bacterial cell wall. It inhibits cross-linkage between the linear peptidoglycan polymer chains that make up a major component of the cell walls of both Gram-positive and Gram-negative bacteria.

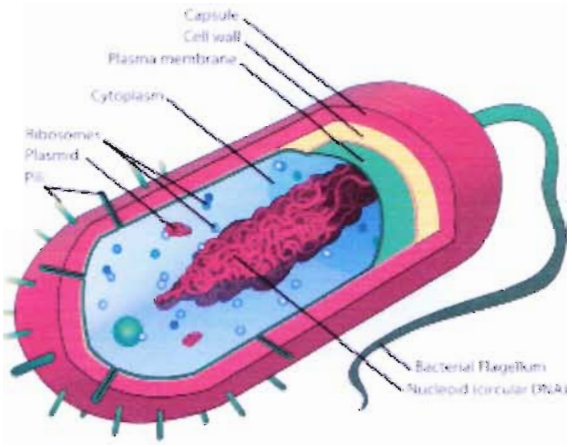


Figure 1: Bacterial cell wall

2.2 FORMULATIONS OF AMOXICILLIN:

Amoxicillin in trihydrate form is available as capsules, chewable and dispersible tablets plus syrup and pediatric suspension for oral use, and as the sodium salt for intravenous administration. It is one of the most common antibiotics prescribed for children, and the liquid forms are helpful where the patient might find it difficult to take tablets or capsules. (**"Moxatag - MiddleBrook Pharmaceuticals to Launch Moxatag in March 2009"**)

2.3 USES OF AMOXICILLIN:

Amoxicillin is used to treat certain infections caused by bacteria, such as pneumonia; bronchitis; gonorrhea; and infections of the ears, nose, throat, urinary tract, and skin. It is also used in combination with other medications to eliminate *H. pylori*, a bacterium that causes ulcers. Amoxicillin is in a class of medications called penicillin-like antibiotics. It works by stopping the growth of bacteria. Antibiotics will not work for colds, flu, and other viral infections. Amoxicillin also is used sometimes to prevent anthrax infection after exposure and to treat anthrax infection of the skin and chlamydia infections during pregnancy. **(American Society of Health-System Pharmacists)**

2.4 POSSIBLE SIDE EFFECTS OF AMOXICILLIN:

- Fever, sore throat, and headache with a severe blistering, peeling, and red skin rash;
- nausea, stomach pain, low fever, loss of appetite, dark urine, clay-colored stools, jaundice (yellowing of the skin or eyes);
- diarrhea that is watery or bloody;
- fever, chills, body aches, flu symptoms;
- easy bruising or bleeding, unusual weakness;
- urinating less than usual or not at all;
- agitation, confusion, unusual thoughts or behavior; or
- seizure (black-out or convulsions).

Less serious side effects are more likely to occur, such as:

- nausea, vomiting, stomach pain;
- vaginal itching or discharge;
- headache;
- swollen, black, or "hairy" tongue; or thrush (white patches or inside your mouth or throat).

2.5 AMOXICILLIN ORAL SUSPENSION:

Amoxicillin for oral suspension contains amoxicillin, a semi synthetic antibiotic, an analog of ampicillin, with a broad spectrum of bactericidal activity against many gram-positive and gram-negative microorganisms. Chemically, it is (2S,5R,6R)-6-[(R)-(-)-2-amino-2-(p-hydroxyphenyl)acetamido]-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylic acid trihydrate. It may be represented structurally as:

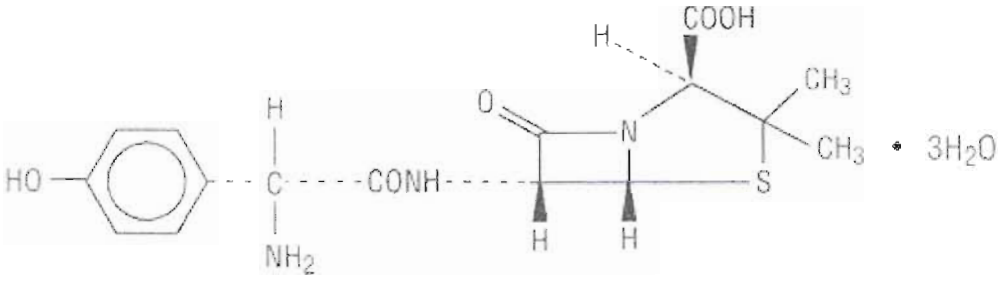


Figure2: Structure of Amoxicillin trihydrate

[C16H19N3O5S•3H2O MW 419.45]

2.6 POWDER FOR ORAL SUSPENSION:

Each 5 mL of reconstituted suspension for oral administration contains 200 mg or 400 mg amoxicillin as the trihydrate. Each 5 mL of the 200 mg reconstituted suspension for oral administration contains 0.09 mEq (2.11 mg) of sodium; each 5 mL of the 400 mg reconstituted suspension for oral administration contains 0.12 mEq (2.69 mg) of sodium. (Pharmacopoeia)

2.7 CLINICAL PHARMACOLOGY:

Amoxicillin is stable in the presence of gastric acid and is rapidly absorbed after oral administration. The effect of food on the absorption of amoxicillin from amoxicillin for oral suspension has been partially investigated. The 400 mg formulation has been studied

only when administered at the start of a light meal. However, food effect studies have not been performed with the 200 mg formulation. Amoxicillin diffuses readily into most body tissues and fluids, with the exception of brain and spinal fluid, except when meninges are inflamed. The half-life of amoxicillin is 61.3 minutes. Most of the amoxicillin is excreted unchanged in the urine; its excretion can be delayed by concurrent administration of probenecid. In blood serum, amoxicillin is approximately 20% protein-bound

Orally administered doses of amoxicillin suspension, 125 mg/5 mL and 250 mg/5 mL, result in average peak blood levels 1 to 2 hours after administration in the range of 1.5 mcg/mL to 3.0 mcg/mL and 3.5 mcg/mL to 5.0 mcg/mL, respectively.

2.8 MICROBIOLOGY

Amoxicillin is similar to ampicillin in its bactericidal action against susceptible organisms during the stage of active multiplication. It acts through the inhibition of biosynthesis of cell wall mucopeptide. Amoxicillin has been shown to be active against most strains of the following microorganisms, both in vitro and in clinical infections as described. **(John Schrefer,2000)**

2.8.a) AEROBIC GRAM-POSITIVE MICROORGANISMS

2.8.a.1) *Enterococcus faecalis*:

Enterococcal species are core constituents of the intestinal flora of many animal species ranging from humans to flies. Enterococci have gained notoriety over the past few decades as frequent causes of multiple antibiotic resistant, hospital-acquired bloodstream, urinary tract and surgical wound infections; and because of their capacity to transfer antibiotic resistances to other microbes. Although more than a dozen different enterococcal species have been associated with human disease, the majority of human enterococcal infections are due to the species *Enterococcus faecalis*.

The ability of *E. faecalis* isolates to cause serious infections has been linked to the intrinsic ruggedness of the bacterium, which allows the organism to persist in the hospital

environment and survive many host defenses, compounded by the acquisition of a variety of variable virulence traits by horizontal transfer from other organisms. **(Shonna M. McBride, 2007)**

Figure 3: Picture of *Enterococcus faecalis*

2.8.a.2) *Staphylococcus* spp.* (β-lactamase-negative strains only):

Staphylococcus can cause a wide variety of diseases in humans and other animals through either toxin production or invasion. Staphylococcal toxins are a common cause of food poisoning, as it can grow in improperly-stored food. *S. aureus* is a member of the Micrococcaceae family. On microscopical examination, the organisms appear as gram-positive cocci in clusters. *S. aureus* is distinguished from other staphylococcal species on the basis of the gold pigmentation of colonies and positive results of coagulase, mannitol-fermentation, and deoxyribonuclease tests. *S. aureus* infection is a major cause of skin, soft-tissue, respiratory, bone, joint, and endovascular disorders. The majority of these infections occur in persons with multiple risk factors for infection. **(Franklin D. Lowy, M.D.1998)**

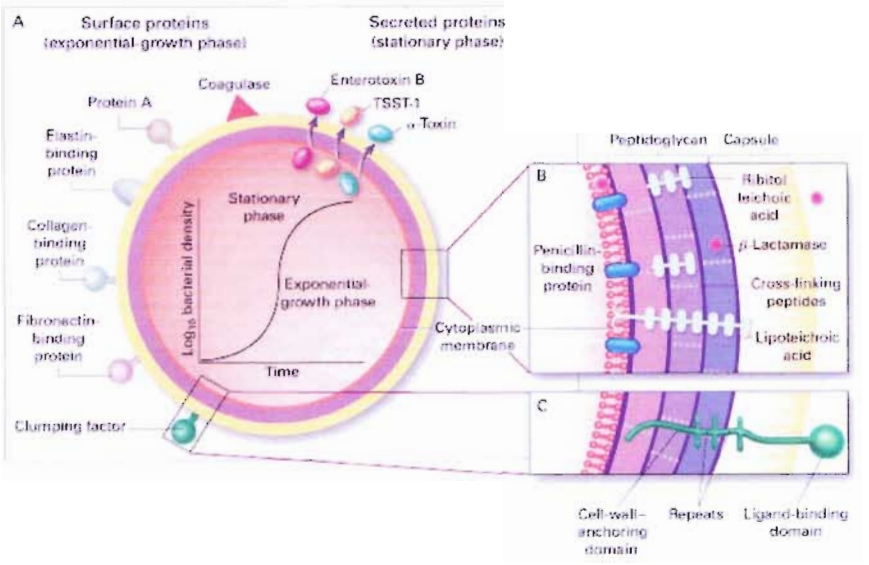


Figure 4: Structure of *S. aureus*

2.8.a.3) *Streptococcus pneumoniae*:

Streptococcus pneumoniae, or **pneumococcus**, is gram-positive, alpha-hemolytic, bile soluble diplococcus aero-tolerant anaerobe and a member of the genus *Streptococcus*. A significant human pathogenic bacterium, *S. pneumoniae* was recognized as a major cause of pneumonia in the late 19th century and is the subject of many humoral immunity studies.

Despite the name, the organism causes many types of pneumococcal infection other than pneumonia, including acute sinusitis, otitis media, meningitis, bacteremia, sepsis, osteomyelitis, septic arthritis, endocarditis, peritonitis, pericarditis, cellulitis, and brain abscess.

S. pneumoniae is the most common cause of bacterial meningitis in adults and children, and is one of the top two isolates found in ear infection, otitis media. Pneumococcal pneumonia is more common in the very young and the very old.

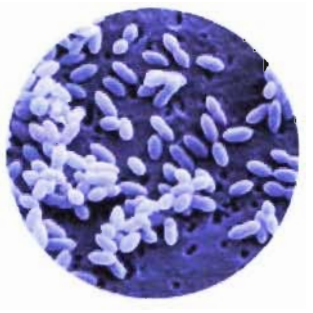


Figure 5: Picture of *Streptococcus pneumoniae*

2.8.a.4) *Streptococcus* spp. (α- and β-hemolytic strains only):

A group of bacteria, familiarly known as strep, that causes a multitude of diseases. The name comes from the Greek 'strepto'- meaning twisted and 'kokkos' meaning berry, and that is exactly what strep look like under the microscope, like a twisted bunch of little round berries. Illness caused by strep includes strep throat, strep pneumonia, scarlet fever, rheumatic fever (and rheumatic heart valve damage), glomerulonephritis, the skin disorder erysipelas.

Group A streptococcal (strep) infections are caused by group A streptococcus, a bacterium responsible for a variety of health problems. These infections can range from a mild skin infection or sore throat to severe, life-threatening conditions such as toxic shock syndrome and necrotizing fasciitis, commonly known as flesh eating disease. Most people are familiar with strep throat, which along with minor skin infection, is the most common form of the disease. Health experts estimate that more than 10 million mild infections (throat and skin) like these occur every year.

In addition to step throat and superficial skin infections, group A strep bacteria can cause infections in tissues (group of cells joined together to perform the same function) at specific body sites, including lungs, bones, spinal cord, and abdomen.

(Group A Streptococcal Infections, Medicine net. 2009)

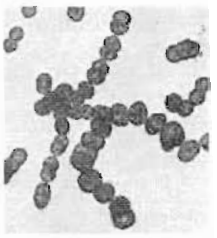


Figure 6: Picture of *Streptococcus* spp

2.8.b) AEROBIC GRAM-NEGATIVE MICROORGANISMS:

2.8.b.1) *Escherichia coli* (β-lactamase-negative strains only)

Escherichia coli is the predominant facultative anaerobe of the human colonic flora. The organism typically colonizes the infant gastrointestinal tract within hours of life, and, thereafter, *E. coli* and the host derive mutual benefit. *E. coli* usually remains harmlessly confined to the intestinal lumen; however, in the debilitated or immunosuppressed host, or when gastrointestinal barriers are violated, even normal "nonpathogenic" strains of *E. coli* can cause infection. Moreover, even the most robust members of our species may be susceptible to infection by one of several highly adapted *E. coli* clones which together have evolved the ability to cause a broad spectrum of human diseases. Infections due to pathogenic *E. coli* may be limited to the mucosal surfaces or can disseminate throughout the body. Three general clinical syndromes result from infection with inherently pathogenic *E. coli* strains: (i) urinary tract infection, (ii) sepsis/meningitis, and (iii) enteric/diarrheal disease. (**James P. Nataro, 1998)**

E. coli (Escherichia coli) is one of several types of bacteria that normally inhabit the intestine of humans and animals (commensal organism). Some strains of *E. coli* are capable of causing disease under certain conditions when the immune system is compromised or disease may result from an environmental exposure. *E. coli* bacteria may give rise to infections in wounds, the urinary tract, biliary tract, and abdominal cavity (peritonitis). This organism may cause septicemia, neonatal meningitis, infantile gastroenteritis, tourist diarrhea, and hemorrhagic diarrhea. An *E. coli* infection may also arise due to environmental exposure. Resistance to beta-lactam antibiotics has become a

particular problem in recent decades, as strains of bacteria that produce extended-spectrum beta-lactamases have become more common. These beta-lactamase enzymes make many, if not all, of the penicillins and cephalosporins ineffective as therapy. Extended-spectrum beta-lactamase–producing *E. coli* are highly resistant to an array of antibiotics and an infection by these strains is difficult to treat. In many instances, only two oral antibiotics and a very limited group of intravenous antibiotics remain effective. Susceptibility testing should guide treatment in all infections in which the organism can be isolated for culture. ***(Jill Granger,et al)***

Figure7: Picture of *E.coli*

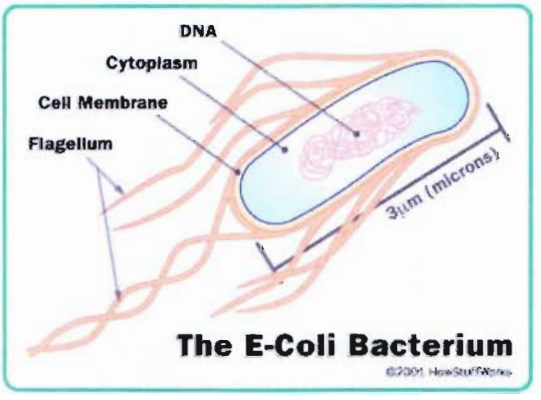


Figure 8: Structure of *E.coli*

2.8.b.2) *Haemophilus influenzae* (β-lactamase-negative strains only):

A gram-negative, rod-shaped bacterium of the genus *Haemophilus* that occurs in the human respiratory tract and causes acute respiratory infections, acute conjunctivitis, and

purulent meningitis; type b is the most common pathogenic form of the bacterium. Also called *Pfeiffer's bacillus*.

Most strains of *H. influenzae* are opportunistic pathogens - that is, they usually live in their host without causing disease, but cause problems only when other factors (such as a viral infection or reduced immune function) create an opportunity.

Naturally-acquired disease caused by *H. influenzae* seems to occur in humans only. In infants and young children, *H. influenzae* type b (Hib) causes bacteremia, pneumonia, and acute bacterial meningitis. Occasionally, it causes cellulitis, osteomyelitis, epiglottitis, and joint infections. Due to routine use of the Hib conjugate vaccine in the U.S. since 1990, the incidence of invasive Hib disease has decreased to 1.3/100,000 in children. However, Hib remains a major cause of lower respiratory tract infections in infants and children in developing countries where vaccine is not widely used. Unencapsulated *H. influenzae* causes ear (otitis media) and eye (conjunctivitis) infections and sinusitis in children, and is associated with pneumonia.

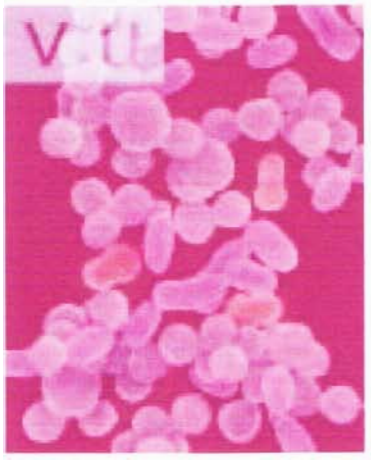


Figure 9: Picture of *Haemophilus influenzae*

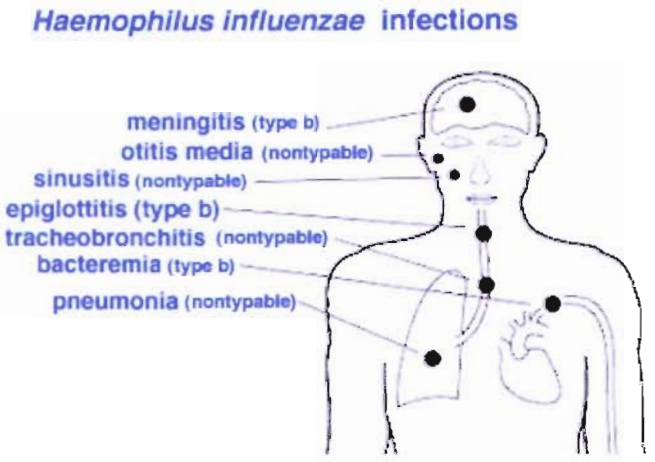


Figure 10: Tissues infected by type b and nontypable strains of *Haemophilus influenzae*

2.8.b.3) *Neisseria gonorrhoeae* (β-lactamase-negative strains only):

Neisseria are fastidious gram-negative cocci, requiring nutrient supplementation to grow in laboratory cultures. These cocci are facultative intracellular and typically appear in pairs (diplococci), in the shape of coffee beans. Of the eleven species of *Neisseria* that colonize humans, only two are pathogens. *N. gonorrhoeae* is the causative agent of gonorrhoea . Symptoms of infection with *N. gonorrhoeae* differ depending on the site of infection. Infection of the genitals can result in a purulent (or pus-like) discharge from the genitals which may be foul smelling, inflammation, redness, swelling, dysuria and a burning sensation during urination.

N. gonorrhoeae can also cause conjunctivitis, pharyngitis, proctitis or urethritis, prostatitis and orchitis.

Conjunctivitis is common in neonates and silver nitrate or antibiotics are often applied to their eyes as a preventive measure against gonorrhoea. Neonatal gonorrheal conjunctivitis is contracted when the infant is exposed to *N. gonorrhoeae* in the birth canal, and can result in corneal scarring or perforation.

Disseminated *N. gonorrhoeae* infections can occur, resulting in endocarditis, meningitis or gonococcal dermatitis-arthritis syndrome. Dermatitis-arthritis syndrome presents with arthralgia, tenosynovitis and painless non-pruritic dermatitis.

Infection of the genitals in females with *N. gonorrhoeae* can result in pelvic inflammatory disease if left untreated, which can result in infertility. Pelvic inflammatory disease results if *N. gonorrhoeae* travels into the pelvic peritoneum (via the cervix, endometrium and fallopian tubes. (**Brian Wong, MD)**

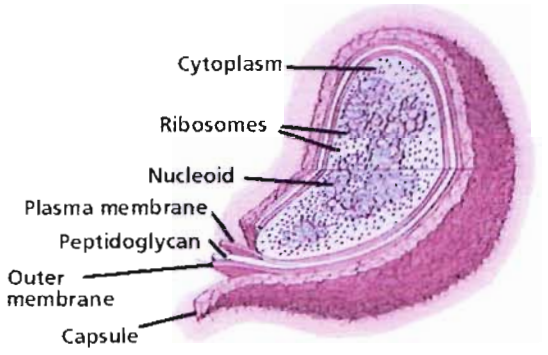


Figure 11: Picture of *Neisseria gonorrhoeae*

2.8.b.4) *Proteus mirabilis* (β-lactamase-negative strains only):

Proteus species are part of the Enterobacteriaceae family of gram-negative bacilli. *Proteus* organisms are implicated as serious causes of infections in humans, along with *Escherichia, Klebsiella, Enterobacter,* and *Serratia* species.

Proteus species are most commonly found in the human intestinal tract as part of normal human intestinal flora, along with *Escherichia coli* and *Klebsiella* species, of which *E coli* is the predominant resident. *Proteus* is also found in multiple environmental habitats, including long-term care facilities and hospitals. In hospital settings, it is not unusual for gram-negative bacilli to colonize both the skin and oral mucosa of both patients and hospital personnel. Infection primarily occurs from these reservoirs. However, *Proteus* species are not the most common cause of nosocomial infections.

Proteus mirabilis causes 90% of *Proteus* infections and can be considered a community-acquired infection. *Proteus vulgaris* and *Proteus penneri* are easily isolated from individuals in long-term care facilities and hospitals and from patients with underlying diseases or compromised immune systems.

Patients with recurrent infections, those with structural abnormalities of the urinary tract, those who have had urethral instrumentation, and those whose infections were acquired in the hospital have an increased frequency of infection caused by *Proteus* and other organisms (eg, *Klebsiella, Enterobacter*, *Pseudomonas,* enterococci, staphylococci)

(http://emedicine.medscape.com/article/226434-overview).

Figure 12: Picture of *Proteus mirabilis*

2.8.b.5) *Helicobacter pylori* : *Helicobacter pylori* (*H. pylori*) is a bacterium that causes chronic inflammation of the inner lining of the stomach (gastritis) in humans. This bacterium also is the most common cause of ulcers worldwide. *H. pylori* infection is most likely acquired by ingesting contaminated food and water and through person to person contact. In the United States, 30% of the adult population is infected. (50% of infected persons are infected by the age of 60.) The infection is more common in crowded living conditions with poor sanitation. In countries with poor sanitation, 90% of the adult population can be infected. Infected individuals usually carry the infection indefinitely unless they are treated with medications to eradicate the bacterium. One out of every six patients with H. pylori infection will develop ulcers of the duodenum or stomach. *H. pylori* also are associated with stomach cancer and a rare type of lymphocytic tumor of the stomach called MALT lymphoma. **(Dennis Lee, M.D.)**

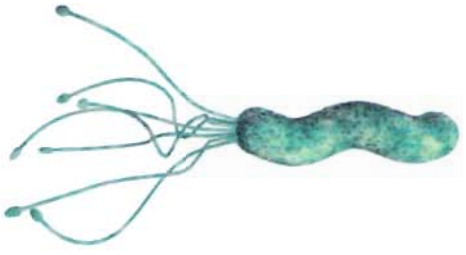


Figure 13: Picture of *Helicobacter pylori*

2.9 DOSAGE AND ADMINISTRATION:

Amoxicillin for oral suspension may be given without regard to meals. The 400 mg suspension has been studied only when administered at the start of a light meal. However, food effect studies have not been performed with the 200 mg formulation.

2.9.1) Neonates and Infants Aged ≤ 12 Weeks (≤ 3 Months)

Due to incompletely developed renal function affecting elimination of amoxicillin in this age group, the recommended upper dose of amoxicillin is 30 mg/kg/day divided q12h.

2.9.2) Adults and Pediatric Patients > 3 Months

Infection	Severity*	Usual Adult Dose	Usual Dose for Children > 3 Months†‡

* Dosing for infections caused by less susceptible organisms should follow the recommendations for severe infections.

† The children's dosage is intended for individuals whose weight is less than 40 kg. Children weighing 40 kg or more should be dosed according to the adult recommendations.

‡ Each strength of amoxicillin oral suspension is available as a chewable tablet for use by

Infection	Severity*	Usual Adult Dose	Usual Dose for Children > 3 Months†‡
older children.			
Ear/Nose/Throat	Mild/Moderate	500 mg every 12 hours or 250 mg every 8 hours	25 mg/kg/day in divided doses every 12 hours or 20 mg/kg/day in divided doses every 8 hours
	Severe	875 mg every 12 hours or 500 mg every 8 hours	45 mg/kg/day in divided doses every 12 hours or 40 mg/kg/day in divided doses every 8 hours or 40 mg/kg/day in divided doses every 8 hours
Lower Respiratory Tract	Mild/Moderate or Severe	875 mg every 12 hours or 500 mg every 8 hours	45 mg/kg/day in divided doses every 12 hours or 40 mg/kg/day in divided doses every 8 hours
Skin/Skin Structure	Mild/Moderate	500 mg every 12 hours or 250 mg every 8 hours	25 mg/kg/day in divided doses every 12 hours or 20 mg/kg/day in divided doses every 8 hours
	Severe	875 mg	45 mg/kg/day in divided doses every 12

Infection	Severity*	Usual Adult Dose	Usual Dose for Children > 3 Months†‡
		every 12 hours or 500 mg every 8 hours	hours or 40 mg/kg/day in divided doses every 8 hours
Genitourinary Tract	Mild/Moderate	500 mg every 12 hours or 250 mg every 8 hours	25 mg/kg/day in divided doses every 12 hours or 20 mg/kg/day in divided doses every 8 hours
	Severe	875 mg every 12 hours or 500 mg every 8 hours	45 mg/kg/day in divided doses every 12 hours or 40 mg/kg/day in divided doses every 8 hours
Gonorrhea Acute, uncomplicated ano-genital and urethral infections in males and females		3 grams as single oral dose	Prepubertal children: 50 mg/kg amoxicillin, combined with 25 mg/kg probenecid as a single dose. NOTE: SINCE PROBENECID IS CONTRAINDICATED IN CHILDREN UNDER 2 YEARS, DO NOT USE THIS REGIMEN IN THESE CASES.

After reconstitution, the required amount of suspension should be placed directly on the child's tongue for swallowing. Alternate means of administration are to add the required amount of suspension to formula, milk, fruit juice, water, ginger ale, or cold drinks. These preparations should then be taken immediately. To be certain the child is receiving full dosage, such preparations should be consumed in entirety. **(Schrefer John,2000)**

2.10) INDICATIONS AND USAGE:

Amoxicillin for oral suspension is indicated in the treatment of infections due to susceptible (ONLY β-lactamase-negative) strains of the designated microorganisms in the conditions listed below:

- Infections of the ear, nose, and throat – due to *Streptococcus spp.* (α- and β-hemolytic strains only), *S. pneumoniae, Staphylococcus spp., or H. influenzae.*
- Infections of the genitourinary tract – due to *E. coli, P. mirabilis, or E. faecalis.*
- Infections of the skin and skin structure – due to *Streptococcus spp. (α- and β-hemolytic strains only), Staphylococcus spp., or E. coli.*
- Infections of the lower respiratory tract – due to *Streptococcus spp. (α- and β-hemolytic strains only), S. pneumoniae, Staphylococcus spp., or H. influenzae.*
- Gonorrhea, acute uncomplicated (ano-genital and urethral infections) – due to *N. gonorrhoeae* (males and females).
- *H. pylori* eradication to reduce the risk of duodenal ulcer recurrence,

2.11) PRECAUTIONS:

2.11.1 GENERAL:

The possibility of super-infections with mycotic or bacterial pathogens should be kept in mind during therapy. If super-infections occur, amoxicillin should be discontinued and appropriate therapy instituted.

A high percentage of patients with mononucleosis who receive ampicillin develop an erythematous skin rash. Thus, ampicillin-class antibiotics should not be administered to patients with mononucleosis.

Prescribing amoxicillin for oral suspension in the absence of a proven or strongly suspected bacterial infection or a prophylactic indication is unlikely to provide benefit to the patient and increases the risk of the development of drug-resistant bacteria.

2.12) DRUG INTERACTIONS:

Probenecid decreases the renal tubular secretion of amoxicillin. Concurrent use of amoxicillin and probenecid may result in increased and prolonged blood levels of amoxicillin.

Chloramphenicol, macrolides, sulfonamides, and tetracyclines may interfere with the bactericidal effects of penicillin. This has been demonstrated in vitro; however, the clinical significance of this interaction is not well documented **(Schrefer John, 2000)**

2.13) ANTIBIOTIC MARKET OF BANGLADESH:

Different β-lactam class of Antibiotic Dry Syrup or Suspension of Medium and Small pharmaceutical companies which are available in the Market of Bangladesh is given below:

Pharmaceutical Company	Generic Name of the Antibiotic	Brand Name of the Antibiotic
	CEPHALOSPORINS CEFRADINE	
ALCO PHARMA (A.P)	Cefradine 125 mg/5 ml: suspension	BETASEF Susp
	Cefradine 250 mg/5 ml: suspension (double strength)	BETASEF DS susp
GLOBE (GBE)	Cefradine 125 mg/5 ml: suspension	EUSEF Susp
NAVANA (NAV)	Cefradine 125 mg/5 ml: suspension	SEFRO Susp
	Cefradine 250 mg/5 ml: suspension (higher strength)	SEFRO HS Susp
RANGS PHARMA (R7G)	Cefradine 125 mg/5 ml: suspension	LINDEX Susp

	Cefradine 250 mg/5 ml: suspension (double strength	**LINDEX DS Susp**
GACO (GCO)	Cefradine 125 mg/5 ml: suspension	**ZECEF Susp**
ZISKA (ZIS)	Cefradine 125 mg/5 ml: suspension	**CEFADIN Susp**
SOMATEC (S&O)	Cefradine 125 mg/5 ml: suspension	**TYDIN Susp**
PACIFIC (PAC)	Cefradine 125 mg/5 ml: suspension	**GIGACEF Susp**
POPULAR PHARMA (PPH)	Cefradine 125 mg/5 ml: suspension	**ROXICEF Susp**
	Cefradine 250 mg/5 ml: suspension (double strength)	**ROXICEF DS Susp**
AMBEE (AMB)	Cefradine 125 mg/5 ml: suspension	**MYCEF Susp**
CHEMICO LABS (CLA)	Cefradine 125 mg/5 ml: suspension	**VELOX Susp**
SILVA PHARMA(SV6)	Cefradine 125 mg/5 ml: suspension	**SICEF Susp**
	Cefradine 250 mg/5 ml: suspension (double strength)	**SICEF DS Susp**
DELTA PHARMA (DLT)	Cefradine 125 mg/5 ml: suspension	**CUSEF Susp**
	Cefradine 250 mg/5 ml: suspension (double strength)	**CUSEF DS Susp**
PHARMADESH (PDH)	Cefradine 125 mg/5 ml: suspension	**P-CEF Susp**
REPHCO (RPH)	Cefradine 125 mg/5 ml: suspension	**REOCEF Susp**
	Cefradine 250 mg/5 ml: suspension (double strength)	**REOCEF DS Susp**
BRISTOL (BRI)	Cefradine 125 mg/5 ml: suspension	**SEFRATE Susp**
EDRUC (EDR)	Cefradine 125 mg/5 ml suspension	**EFRAD Susp**
AMICO (AIC)	Cefradine 125mg/5ml: suspension	**BELOCEF Susp**
	Cefradine 250mg/5ml: suspension (double strength)	**BELOCEF DS Susp**
MEDICON (MED)	Cefradine 125 mg/5 ml: suspension	**MEDICEF Susp**
GONOSHASTAYA (GNS)	Cefradine 125 mg/5 ml: suspension	**G-CEFRADINE Susp**
SUPREME PHARMA (SPR)	Cefradine 125mg/5ml: suspension	**ADECEF Susp**
	Cefradine 250 mg/5ml: suspension (double strength)	**ADECEF DS Susp**
APOLLO (ALO)	Cefradine 125 mg/5 ml: suspension	**ACEFRA Susp**
DESH PHARMA (DSH)	Cefradine 125 mg/5 ml: suspension	**MULTICEF Susp**
WHITE HORSE PHARMA (WTH)	Cefradine 125 mg/5 ml: suspension	**WINCEF Susp**

KUMUDINI PHARMA (KUM)	Cefradine 125 mg/5 ml: suspension	SEFACIN Susp
SYNTHO LABS (SYH)	Cefradine 125 mg/5ml: suspension	CEFRASYN Susp
MODERN (MOD)	Cefradine 125 mg/5 ml: suspension	MEFRAD Susp

	CEPHALOSPORINS CEFIXIME	
ALCO PHARMA (A.P)	Cefixime trihydrate 100 mg/5 ml: suspension	SAVER Susp
GLOBE (GBE)	Cefixime trihydrate 100 mg/5 ml: suspension	CEFIX Susp
NAVANA (NAV)	Cefixime trihydrate 100 mg/5 ml: suspension	DURACEF Susp
GACO (GCO)	Cefixime trihydrate 100 mg/5 ml: suspension	G-FIX Susp
ZISKA (ZIS)	Cefixime trihydrate 100 mg/5 ml: suspension	PREXIM Susp
SOMATEC (S&O)	Cefixime trihydrate 100 mg/5 ml: suspension	TGOCEF Susp
PACIFIC (PAC)	Cefixime trihydrate 100 mg/5 ml: suspension	TRIFIX Susp
POPULAR PHARMA (PPH)	Cefixime trihydrate 100 mg/5 ml: suspension	ZEMICEF Susp
AMBEE (AMB)	Cefixime trihydrate 100 mg/5 ml: suspension	TRICEF Susp
CHEMICO LABS (CLA)	Cefixime trihydrate 100 mg/5 ml: suspension	KEFIM Susp
SILVA PHARMA (SV6)	Cefixime trihydrate 100 mg/5 ml: suspension	SUPRAXIM Susp
DELTA PHARMA (DLT)	Cefixime trihydrate 100 mg/5 ml: suspension	OFEX Susp
PHARMADESH (PDH)	Cefixime trihydrate 100 mg/5 ml: suspension	CEFOCEF Susp
REPHCO (RPH)	Cefixime trihydrate 100 mg/5 ml: suspension	KEOR Susp
BRISTOL (BRI)	Cefixime trihydrate 125 mg/ 5 ml: suspension	XIFIM Susp
EDRUC (EDR)	Cefixime trihydrate 125 mg/ 5 ml: suspension	3-C Susp
AMICO (AIC)	Cefixime trihydrate 100 mg/5 ml: suspension	GEN-3 Susp
MEDICON (MED)	Cefixime trihydrate 100 mg/5 ml: suspension	PROFIX Susp
SUPREME PHARMA (SPR)	Cefixime trihydrate 100 mg/5 ml: suspension	ADEXIM Susp
WHITE HORSE PHARMA (WTH)	Cefixime trihydrate 100 mg/5 ml: suspension	TYFAX-3 Susp
KUMUDINI PHARMA (KUM)	Cefixime trihydrate 100 mg/5 ml: suspension	CEFADYL Susp
SYNTHO LABS (SYH)	Cefixime trihydrate 125 mg/ 5 ml: suspension	UNIFIX Susp

	CEPHALOSPORINS CEFUROXIME AXETIL	
ALCO PHARMA (A.P)	Cefuroxime axetil	AXETIL Susp

	125 mg/5 ml: suspension	
ZISKA (ZIS)	Cefuroxime axetil 125 mg/5 ml:suspension	XITIL Susp
SOMATEC (S&O)	Cefuroxime axetil 125mg/ 5 ml: suspension	CEFURIM Susp

	CEPHALOSPORINS CEFPODOXIME PROXETIL	
ALCO PHARMA (A.P)	Cefpodoxime proxetil INN 40mg/5ml: dry suspension	CEPDOXIM Susp
NAVANA (NAV)	Cefpodoxime proxetil INN 40 mg/5 ml: suspension	SEFOX Susp
SOMATEC (S&O)	Cefpodoxime proxetil INN 40 mg/5 ml: dry suspension	NEOPROX Susp
POPULAR PHARMA (PPH)	Cefpodoxime proxetil INN 40 mg/ 5ml: dry suspension	CEFOMIN Susp
DELTA PHARMA (DLT)	Cefpodoxime proxetil INN 40 mg/5 ml: suspension	TORAXIM Susp
BRISTOL (BRI)	Cefpodoxime proxetil INN 40mg/5ml: dry suspension	CEFODOX Susp
KUMUDINI PHARMA (KUM)	Cefpodoxime proxetil **INN 40 mg/ 5ml: suspension**	XIMOCEF Susp

	CEPHALOSPORINS CEFALEXIN	
GLOBE (GBE)	**Cefalexin** 125 mg/5 ml: suspension	CEPA Susp
NAVANA (NAV)	**Cefalexin** 125 mg/5 ml: suspension	NAVALEXIN Susp
PHARMADESH (PDH)	**Cefalexin** 125 mg/5 ml: Suspension	CEPHAXIN Susp
EDRUC (EDR)	**Cefalexin** 125 mg/5 ml: suspension	EDICEF Susp
SKYLAB (SKL)	**Cefalexin** 125 mg/5 ml:suspension	CEPHAROL Susp
GONOSHASTAYA (GNS)	**Cefalexin** 125 mg/5 ml: suspension	G-CEFALEXIN Susp

.POLLO (ALO)	**Cefalexin** 125 mg/5 ml: Suspension	**ASEF Susp**
EEMA (SEE)	**Cefalexin** 125 mg/5 ml: suspension	**SEEMACEPH Susp**

	CEPHALOSPORINS **CEFADROXIL**	
RANGS PHARMA (R7G)	Cefadroxil monohydrate USP 125mg/5 ml: suspension	**DROXIL Susp**
ZISKA (ZIS)	Cefadroxil monohydrate USP 125mg/5 ml: suspension	**ADOCEF Susp**
SOMATEC (S&O)	Cefadroxil monohydrate USP 125mg/5 ml: suspension	**CEFADOR Susp**

	BROAD SPECTRUM PENICILLINS **AMOXYCILLIN**	
ALCO PHARMA (A.P)	Amoxycillin 125 mg/5 ml: suspension	**SAPOX Susp**
	Amoxycillin 250mg/5ml:suspension (double strength)	**SAPOX-DS Susp**
GLOBE (GBE)	Amoxycillin 125 mg/5 ml: suspension	**ULTRAMOX Susp**
NAVANA (NAV)	Amoxycillin 125 mg/5 ml: suspension	**NAVAMOX Susp**
RANGS PHARMA (R7G)	Amoxycillin 125 mg/5 ml: suspension	**ANTIF Susp**
	Amoxycillin 250 mg/ 5 ml: suspension (double strength)	**ANTIF DS Susp**
GACO (GCO)	Amoxycillin 125 mg/5 ml: suspension	**UNIMOX Susp**
ZISKA (ZIS)	Amoxycillin 125 mg/5 ml: suspension	**ZIMOXYL Susp**
SOMATEC (S&O)	Amoxycillin 125 mg/5 ml: suspension	**TYMOX Susp**
PACIFIC (PAC)	Amoxycillin 125 mg/5 ml: suspension	**AMOCIN Susp**
AMBEE (AMB))	Amoxycillin 125 mg/5 ml: suspension	**AMBEEXIN Susp**
CHEMICO LABS (CLA)	Amoxycillin 125 mg/5 ml: suspension	**KAMOXY Susp**
SILVA PHARMA (SV6)	Amoxycillin 125 mg/5 ml: suspension	**SIMOX Susp**
	Amoxycillin 250 mg/5 ml: suspension (double strength)	**SIMOX DS Susp**

PHARMADESH (PDH)	Amoxycillin 125 mg/5 ml: suspension	**PHARMOXYL Susp**
REPHCO (RPH)	Amoxycillin 125 mg/5 ml: suspension	**REMOXIN Susp**
	Amoxycillin 250mg/5ml:suspension (double strength)	**REMOXIN DS Susp**
BRISTOL (BRI)	Amoxycillin 125 mg/5 ml: suspension	**BPMOX Susp**
EDRUC (EDR)	Amoxycillin 125 mg/5 ml: suspension	**E-MOX Susp**
AMICO (AIC)	Amoxycillin 125 mg/5 ml: suspension	**MONAMOX Susp**
	Amoxycillin 250 mg/5 ml: suspension (double strength)	**MONAMOX DS Susp**
MEDICON (MED)	Amoxycillin 125 mg/5 ml: suspension	**AMOXICON Susp**
SKYLAB (SKL)	Amoxycillin 125 mg/5 ml: suspension	**SKYMOXIN Susp**
GONOSHASTAYA (GNS)	Amoxycillin 125 mg/5 ml: suspension	**G-AMOXYCILLIN Susp**
SUPREME PHARMA (SPR)	Amoxycillin 125 mg/5 ml: suspension	**MOXICO Susp**
	Amoxycillin 250 mg/5 ml: suspension (double strength)	**MOXICO DS Susp**
APOLLO (ALO)	Amoxycillin 125 mg/5 ml: suspension	**APIMOX Susp**
DESH PHARMA (DSH)	Amoxycillin 125 mg/ 5 ml: suspension (double strength)	**DEMOX Susp**
WHITE HORSE PHARMA (WTH)	Amoxycillin 125 mg/5 ml: suspension	**FLYMOX Susp**
KUMUDINI PHARMA (KUM)	Amoxycillin 125 mg/5 ml: suspension	**CLAMOX Susp**
SYNTHO LABS (SYH)	Amoxycillin 125 mg/5 ml: suspension	**AMOCIL Susp**
SEEMA (SEE)	Amoxycillin 125 mg/5 ml: suspension	**SEEMAXYL Susp**
MODERN (MOD)	Amoxycillin 125 mg/5 ml: suspension	**AMOXIMA Susp**

	MED+ NARROW SPECTRUM PENICILLIN **FLUCLOXACILLIN**	
ALCO PHARMA (A.P)	Flucloxacillin 250 mg/5 ml: suspension	**CAPFLU DS Susp**
	Flucoxacillin 125mg/5ml:suspension	**FLUSYRUP Susp**
GLOBE (GBE)	Flucloxacillin sodium 125 mg/5 ml: suspension	**ISOCLOX Susp**
NAVANA (NAV)	Flucloxacillin 125 mg/5 ml: suspension	**FLUBIOTIC Susp**
RANGS PHARMA (R7G)	Flucloxacillin sodium	**PERPEN Susp**

	125 mg/5 ml: suspension	
GACO (GCO)	Flucloxacillin 125 mg/5 ml: suspension	FCX Susp
ZISKA (ZIS)	Flucloxacillin sodium 125 mg/5 ml: suspension	FLUXI Susp
SOMATEC (S&O)	Flucloxacillin 125 mg/5 ml: suspension	FLUCOPEN Susp
PACIFIC (PAC)	Flucloxacillin 125 mg/5 ml: suspension	STAPKILL Susp
AMBEE (AMB)	Flucloxacillin sodium 125 mg/5 ml: suspension	FLUXIN Susp
SILVA PHARMA (SV6)	Flucloxacillin sodium 125 mg/5 ml: suspension	SILOX Susp
PHARMADESH (PDH)	Flucloxacillin sodium 125 mg/5 ml: suspension	STAPHYLOX Susp
REPHCO (RPH)	Flucloxacillin sodium 125 mg/5 ml: suspension	SOFTAPEN Susp
BRISTOL (BRI)	Flucloxacillin 125 mg/5 ml: suspension	FLAC Susp
EDRUC (EDR)	Flucloxacillin 125 mg/5 ml: suspension	E-FLU Susp
AMICO (AIC)	Flucloxacillin sodium 125 mg/5 ml: suspension	MONACLOX-F Susp
	Flucloxacillin sodium 250mg/5ml:suspension (double strength)	MONACLOX-F DS Susp
MEDICON (MED)	Flucloxacillin 125 mg/5 ml: suspension	FLUMED Susp
SUPREME PHARMA (SPR)	Flucloxacillin 125 mg/5 ml: suspension	FULCIN Susp
APOLLO (ALO)	Flucloxacillin sodium 125 mg/5 ml: suspension	SOFA Susp
DESH PHARMA (DSH	Flucloxacillin 125 mg/5 ml: suspension	FLUCLOXI Susp
WHITE HORSE PHARMA (WTH)	Flucloxacillin 125 mg/5 ml: suspension	FLUSUN Susp
KUMUDINI PHARMA (KUM)	Flucloxacillin 125 mg/5 ml: suspension	FAXILIN Susp
SYNTHO LABS (SYH)	Flucloxacillin 125 mg/5 ml: suspension	SYFLU Susp
MODERN (MOD)	Flucloxacillin 125 mg/5 ml: suspension	ENOCLOX Susp

	MED+ NARROW SPECTRUM PENICILLIN PENICILLIN V	
DESH PHARMA (DSH)	Phenoxymethyl penicillin 125mg/5ml: suspension	ORA-K Susp

	SYRUPS	
GLOBE (GBE)	Cloxacillin 125mg/5 ml: syrup	ULTRACLOX Syp

VANA (NAV)	Cloxacillin 125 mg/5ml: Syrup	NAVACLOX Syp
CO (GCO)	Cloxacillin 125 mg/5ml: Syrup	SIMPICLOX Syp
	Phenoxymethyl penicillin 125mg/5ml: syrup	ERACILLIN-K Syp
MATEC (S&O)	Levofloxacin hemihydrate INN 125 mg/5 ml:syrup	LEVORA Syp
PULAR PHARMA (PPH)	Levofloxacin hemihydrate INN 125 mg/5 ml: syrup	LEVOBAC Syp
EMICO LABS (CLA)	Cloxacillin 125 mg/5ml: Syrup	OMNICLOX Syp
ARMADESH (PDH)	Phenoxymethyl penicillin 125mg/5ml: syrup	PHARMAPEN Syp
ISTOL (BRI)	Cloxacillin 125mg/5ml: syrup	BPCLOX Syp
RUC (EDR	Penicillin V 125 mg in 5 ml: syrup	CYTAPEN-V Syp
YLAB (SKL)	Cloxacillin 125mg/5ml: syrup	CLOXAPEN Syp
	Phenoxymethyl penicillin 125mg/5ml: syrup	PENCI-V Syp
NOSHASTAYA (GNS)	Cloxacillin 125 mg/5ml: Syrup	G-CLOXACILLIN Syp
	Phenoxymethyl penicillin 125mg/5ml: syrup	G-PENICILLIN V Syp

st of Antibiotic preparations manufactured by Big Pharmaceutical Companies Bangladesh:

SQUARE Pharmaceuticals Ltd		
GENERIC NAME	**BRAND NAME**	**DOSE**
	CEPHALOSPORINS	
EPHRADINE	LEBAC Cap.Square	250mg and 500 mg/Cap
	LEBAC Susp.Square	125mg/500ml
	LEBAC Frote Susp.Square	250mg/5ml
	LEBAC Drop.Square	100mg/1ml
	LEBAC Inj.Square	500mg and 1mg/vial
EFIXIME	CEF-3 Cap.Square	200mg/Cap
	CEF-3 Susp.Square	100mg/5ml
EFUROXIME	CEFOTIL Tab.Square	125mg and 250mg/Tab
	CEFOTIL Inj.Square	750mg/vial
EFPODOXIME	VANPROX Tab.Square	100mg or 200mg/Tab
	VANPROX Susp.Square	40mg/5ml
	VANPROX Drop.Square	20mg/1ml;dry Susp
EFACLOR	LORACEF Cap.Square	250mg and 500mg/Cap
	LORACEF 375 ER Tab.Square	375mg/Tab
	LORACEF Susp.Square	125mg/5ml
	LORACEF Drop.Square	100mg/1ml
EPHALEXIN	CEPORIN Cap.Square	250mg and 500mg/Cap
	CEPORIN DT Square	250mg/divisible Tab

	CEPORIN Susp.Square	125mg/5ml
CEFDINIR	CEFDIR Cap.Square	300mg/Cap
	CEFDIR Susp.Square	125mg/5ml
CEFTRIAXONE	CEFTRON I.M Inj.Square	250mg,500mg, and 1gm vial with lidocaine
	CEFTRON I.V Inj.Square	250mg,500mg,1gm and 2gm vial with water
CEFTAZIDIME	TAZID Inj.Square	250mg,500mg and 1gm vial; i.m/i,v Inj.
CEFOTAXIME	MAXCEF Inj.Square	250mg,500mg and 1gm/vial
CEFTIZOXIME		
CEFPIROME	FORCE Inj.Square	1gm/vial with water; i.v Inj.
	FLUOROQUINOLONES	
CIPROFLOXACIN	CIPROCIN Tab. Square	250mg,500mg and 750mg/Tab.
	CIPROCIN Eye drop.Square	0.3% Eye drop
LEVOFLOXACIN	TEREVOX Tab.Square	250mg and 500mg/Tab
SPARFLOXACIN	SAGA Tab. Square	200mg/Tab
NORFLOXACIN		
OFLOXACIN	RUTIX Tab.Square	200mg and 400mg/Tab
GATIFLOXACIN	GATI 400 Tab.Square	400mg/Tab
LOMEFLOXACIN	MEXLO Tab.Square	400mg/Tab
	BROAD SPECTRUM PENICILLIN	
AMOXYCILLIN	MOXACIL Cap.Square	250mg and 500mg/Cap
	MOXACIL 875 Tab.Square	875mg/Tab
	MOXACIL DT Tab.Square	250mg/Tab
	MOXACIL Susp. Square	125mg/5ml
	MOXACIL Forte Susp. Square	250mg/5ml
	MOXACIL Drop.Square	125mg/1.25ml
	MOXACIL Inj.Square	250mg and 500mg/vial
CLAVULANIC ACID		
PIVMECILLINAM	EMCIL Tab.Square	200mg/Tab
	MACROLIDES AND SIMILAR TYPE	
AZITHROMYCIN	ZIMAX Cap.Square	250mg/Cap
	ZIMAX Tab.Square	500mg/Tab
	ZIMAX Susp.Square	200mg/5ml
ERYTHROMYCIN	EROMYCIN Tab.Square	250mg/Tab
	EROMYCIN DS Tab.Square	500mg/Tab
	EROMYCIN Susp.Square	125mg/5ml
	EROMYCIN Drop.Square	200mg/5ml
CLARITHROMYCIN	REMAC Tab.Square	250mg and 500mg/Tab
	MEDIUM + NARROW SPECTRUM PENICILLIN	
FLUCLOXACILLIN	PHYLOPEN Cap.Square	250mg/Cap
	PHYLOPEN DS Cap.Square	500mg/Cap
	PHYLOPEN Susp.Square	125mg/5ml
	PHYLOPEN Forte Susp.Square	250mg/5ml
	PHYLOPEN Inj.Square	250mg and 500mg/vial
PENICILLIN V	PENVIK Tab.Square	250mg/Tab

	PENVIK DS Tab.Square	500mg Tab
	PENVIK Forte Syp.Square	250mg/5ml
	PENVIK Syp.Square	125mg/5ml
	TETRACYCLINES AND COMBS	
DOXYCYCLINE	DOXACIL Cap.Square	100mg/Cap
TETRACYCLINE	TETRAX Cap.Square	500mg/Cap
NICOTINAMIDE		
CHLORAMPHENICOL	SQ-MYCETIN E/E Drop Square	0.5%Eye/Ear Drop
THIAMINE	BEOVIT Tab.Square	100mg/Tab
ROLITETRACYCLINE		
CYANOCOBALAMIN		
	AMINOGLYCOSIDES	
GENTAMICIN	GENACYN Inj.Square	80mg/2ml ampoule
	GENACYN Paed. Inj.Square	20mg/2ml ampoule
	GENACYN Oint.Square	0.1%Ointment
	GENACYN Eye Drop Square	0.3%Eye Drop
	GENACYN E/E Drop Square	0.3%Ear/Eye Drop
	BEXIMCO Pharmaceuticals Ltd	
GENERIC NAME	**BRAND NAME**	**DOSE**
	CEPHALOSPORINS	
CEPHRADINE	INTRACEF Cap.Beximco	250mg and 500mg/Cap
	INTRACEF Susp.Beximco	125mg/5ml
	INTRACEF DS Susp.Beximco	250mg/5ml
	INTRACEF Drop Beximco	100mg/1ml
	INTRACEF Inj.Beximco	250mg and 500mg/vial
CEFIXIME	TRIOCIM Cap.Beximco	200mg/Cap
	TRIOCIM Susp.Beximco	125mg/5ml
CEFPODOXIME	VERCEF Susp.Beximco	40mg/5ml
CEPHALEXIN	CEPHALEN Cap.Beximco	250mg and 500mg/Cap
	CEPHALEN Susp.Beximco	125mg/5ml
CEFDINIR	CEFIDA Cap.Beximco	300mg/Cap
	CEFIDA Susp.Beximco	125mg/5ml
CEFTRIAXONE	ARIXON I.M Inj.Beximco	250mg,500mg and 1gm/vial
	ARIXON I.V Inj.Beximco	250mg,500mg and1gm/vial
CEFTIZOXIME		
	FLUOROQUINOLONES	
CIPROFLOXACIN	NEOFLOXIN Tab.Beximco	250mg,500mg and 750mg/Tab
	NEOFLOXIN XR Tab.Beximco	500mg/Tab;extended release
	NEOFLOXIN Inj.Beximco	200mg in 100ml bot
LEVOFLOXACIN	EVO Tab.Beximco	250mg and 500mg/Tab
SPARFLOXACIN	SPARLIN Tab.Beximco	200mg/Tab
NORFLOXACIN		
GATIFLOXACIN	XEGAL Tab.Beximco	400mg/Tab(Film-coated)
PEFLOXACIN	ISOFLOXIN Tab.Beximco	400mg/Tab
MOXIFLOXACIN	ODYCIN Tab.Beximco	400mg/Tab
	BROAD SPECTRUM PENICILLIN	
AMOXYCILLIN	TYCIL Cap.Beximco	250mg and 500mg/Cap

	TYCIL Susp.Beximco	125mg/5ml
	TYCIL DS Susp.Beximco	250mg/5ml
	TYCIL Drop.Beximco	125mg/1.25ml
CLAVULANIC ACID		
CLOXACILLIN	CLOBEX Cap.Beximco	500mg/Cap
	CLOBEX Syp.Beximco	125mg/5ml
EPICILLIN		
HETACILLIN		
MACROLIDES AND SIMILAR TYPE		
AZITHROMYCIN	AZITHROCIN Cap.Beximco	250mg/Cap
	AZITHROCIN Tab.Beximco	500mg/Tab
	AZITHROCIN Susp.Beximco	200mg/5ml
ERYTHROMYCIN	ETROCIN Tab.Beximco	250mg and 500mg/Tab
	ETROCIN Susp.Beximco	125mg/5ml
CLARITHROMYCIN	ROLACIN Tab.Beximco	250mg and 500mg/Tab
MEDIUM + NARROW SPECTRUM PENICILLIN		
FLUCLOXACILLIN	FLUBEX Cap.Beximco	250mg and 500mg/Cap
	FLUBEX Susp.Beximco	125mg/5ml
TETRACYCLINES AND COMBS		
DOXYCYCLINE	MEGADOX Cap.Beximco	100mg/Cap
TETRACYCLINE	DECACYCLINE Cap.Beximco	250mg/Cap
NICOTINAMIDE		
PANTOTHENIC ACID		
THIAMINE	AVTRON-V Tab.Beximco	100mg/Tab
ROLITETRACYCLINE		
CYANOCOBALAMIN		
AMINOGLYCOSIDES		
GENTAMICIN	INVIGEN Inf.Beximco	80mg/100ml
	GENTOSIP Cream Beximco	0.3% Cream
KANAMYCIN		
METACYCLINE		
INCEPTA PHARMA		
GENERIC NAME	**BRAND NAME**	**DOSE**
CEPHALOSPORINS		
CEPHRADINE	PROCEF Cap.Incepta	250mg and 500mg/Cap
	PROCEF Susp.Incepta	125mg/5ml
	PROCEF Forte Susp.Incepta	250mg/5ml
	PROCEF Drop Incepta	100mg/1ml
	PROCEF Inj.Incepta	250mg,500mg and 1 gm/vial;i.m/i.v inj
CEFIXIME	EMIXEF Cap.Incepta	200mg/Cap
	EMIXEF Susp.Incepta	100mg/5ml
CEFUROXIME	KILBAC Tab.Incepta	125mg,250mg and 500mg Tab
	KILBAC Susp.Incepta	125mg/5ml
	KILBAC 250 Inj.Incepta	250mg/vial
	KILBAC 750 Inj.Incepta	750mg/vial
CEFPODOXIME	XIMEPROX Cap.Incepta	100mg/Cap
	XIMEPROX Tab.Incepta	100mg and 200mg/Tab

	XIMEPROX Susp.Incepta	40mg/5ml
	XIMEPROX Drop Incepta	20mg/1ml
CEFACLOR	OTICLOR Cap.Incepta	250mg and 500mg/Cap
	OTICLOR Susp.Incepta	125mg/5ml
	OTICLOR Drop Incepta	100mg/1ml
CEFADROXIL	ADORA Cap.Incepta	500mg/Cap
	ADORA Susp.Incepta	125mg/5ml
	ADORA Drop Incepta	100mg/1ml
CEFTRIAXONE	EXEPHIN I.M Inj. Icepta	250gm, 500mg and 1gm vial with lidocaine
	EXEPHIN I.V Inj. Incepta	250mg, 500mg and 1gm vial with water
CEFTAZIDIME	SIDOBAC Inj. Incepta	250mg, 500mg and 1gm vial; i.m/i.v Inj.
CEFEPIME	ULTRAPIME Inj. Icepta	500mg and 1gm vial with water
FLUOROQUINOLONES		
CIPROFLOXACIN	BEUFLOX Tab.Incepta	250mg, 500mg and 750mg/Tab
	BUEFLOX Susp. Icepta	250mg /5ml
LEVOFLOXACIN	LEVOXIN Tab.Incepta	250mg, 500mg and 750 mg/Tab
NORFLOZACIN		
GATIFLOXACIN	GATIFLOX Tab.Icepta	400mg/Tab(film-coated)
BROAD SPECTRUM PENICILLIN		
AMOXYCILLIN	PRIMOX 500 Tab.Incepta	500mg/Tab
CLAVULANIC ACID		
MACROLIDES AND SIMILAR TYPE		
AZITHROMYCIN	TRIDOSIL Tab.Incepta	250mg and 500mg/Tab
	TRIDOSIL Susp.Incepta	200mg/5ml
ERYTHROMYCIN	FIRMAC Tab.Incepta	250mg and 500mg/Tab
	FIRMAC Susp.Incepta	125mg/5ml
ROXITHROMYCIN	PEDILID Tab.Incepta	150mg and 300mg/Tab
	PEDILID Susp.Incepta	50mg/5ml

The ACME Laboratories Ltd

GENERIC NAME	BRAND NAME	DOSE
CEPHALOSPORINS		
CEPHRADINE	SEFRIL Cap.Acme	250mg and 500mg / Cap
	SEFRIL Susp.Acme	125mg/5ml
	SEFRIL Inj.Acme	500mg and 1 gm/vial
	SEFRIL Drop Acme	100mg/ml
CEFIXIME	FIX-A Cap.Acme	200mg/Cap
	FIX-A Susp.Acme	100mg/5ml
CEFADROXIL	TWICEF Cap.Acme	500mg/Cap
	TWICEF Susp. Acme	125mg/5ml
	TWICEF Drop Acme	100mg/1ml
CAPHALEXIN	ACELEX Cap.Acme	250mg and 500mg/Cap
	ACELEX Susp. Acme	125mg/5ml
	ACELEX Drop Acme	100mg/1ml
CEFTRIAXONE	TRIZON I.M Inj.Acme	250mg,500mg and 1gm vial with 1% lidocaine

	TRIZON I.V Inj.Acme	250mg,500mg and 1gm vial with water
FOTAXIME	TAXIM Inj.Acme	250mg,500mg and 1gm/vial
FUROXIME		
FTIZOXIME		
	FLUOROQUINOLONES	
PROFLOXACIN	CIPRO-A Eye Drop Acme	0.3% eye drop
VOFLOXACIN	LEO Tab.Acme	250mg and 500 mg/Tab
ARFLOXACIN	FLOXIPAR Tab.Acme	200mg/Tab
ORFLOXACIN		
ATIFLOXACIN	GATOX Tab.Acme	400mg/Tab (film-coated)
	BROAD SPECTRUM PENICILLIN	
MOXYCILLIN	MOXILIN Cap.Acme	250mg and 500mg/Cap
	MOXILIN Susp.Acme	125mg/5ml
	MOXILIN Inj.Acme	250mg and 500mg/vial
	MOXILIN Drop.Acme	125mg/1.25ml
MPICILLIN	ACMECILIN Cap.Acme	250mg/Cap
	ACMECILIN Susp.Acme	125mg/5ml
	ACMECILIN Inj.Acme	250mg and 500mg/vial
LOXACILLIN	A-CLOX Cap.Acme	500mg/Cap
	A-CLOX Dry Syp.Acme	125mg/5ml
	A-CLOX Inj.Acme	250mg and 500mg/vial
	A-CLOX Paed.Drop Acme	125mg/1.25ml
	MACROLIDES AND SIMILAR TYPE	
ZITHROMYCIN	AZIN Cap.Acme	250mg/Cap
	AZIN Tab.Acme	500mg/Tab
	AZIN Susp.Acme	200mg/5ml
RYTHROMYCIN	EROCIN Tab.Acme	250mg and 500mg/Tab
	EROCIN Susp.Acme	125mg/5ml
LARITHROMYCIN	CLARICIN Tab.Acme	250mg and 500mg/Tab
	MEDIUM + NARROW SPECTRUM PENICILLIN	
LUCLOXACILLIN	A-FLOX Cap.Acme	250mg and 500mg/Cap
	A-FLOX Susp.Acme	125mg/5ml
	A-FLOX Inj.Acme	250mg and 500mg/vial
ENICILLIN G	COMBIPEN 4 Lac Inj.Acme	Procaine penicillin 3 lac+Benzyl penicillin 1 lac/vial
	TETRACYCLINES AND COMBS	
OXYCYCLINE	DOXY-A Cap.Acme	100mg/Cap
ETRACYCLINE	A-TETRA Cap.Acme	500mg/Cap
	A-TETRA Tab.Acme	500mg/Tab
	A-TETRA Eye Oint.Acme	Tetracycline hydrochloride 1% Eye Oint
XYTETRACYCLINE	OXECYLIN Cap.Acme	250mg/Cap
ICOTINAMIDE		
ANTOTHENIC ACID		
HLORAMPHENICOL	A-PHENICOL Eye Drop Acme	Chlorampehenicol 0.5% Eye drop
	A-PHENICOL Eye Oint.Acme	Chloramphenicol 1% Eye Oint
HIAMINE	A-B1 Tab.Acme	Thiamine hydrochloride 100mg/Tab

AMINOGLYCOSIDES		
GENTAMYCIN	GENTACIN Eye Oint.Acme	Gentamicin sulph. 0.3% Eye Oint.
ESKAYEEF-Bangladesh Ltd		
GENERIC NAME	**BRAND NAME**	**DOSE**
CEPHALOSPORINS		
CEPHRADINE	SK-CEF Cap.SK+F	250mg and 500mg/Cap
	SK-CEF Susp.SK+F	125mg/5ml
	SK-CEF DS Susp.SK+F	250mg/5ml
	SK-CEF Drop SK+F	100mg/1ml
	SK-CEF Inj.SK+F	500mg and 1 gm/vial
CEFIXIME	ROXIME Cap.SK+F	200mg and 400mg/Cap
	ROXIME Susp.SK+F	100mg/5ml
CEFPODOXIME	STARIN Cap.SK+F	100mg and 200mg/Cap
	STARIN Susp.SK+F	40mg/5ml
	STARIN DS Susp.SK+F	80mg/5ml
	STARIN Drop SK+F	20mg/1ml
CEFACLOR	CEFLON Cap.SK+F	250mg and 500mg/Cap
	CEFLON Susp.SK+F	125mg/5ml
	CEFLON Drop SK+F	100mg/1ml
CEFADROXIL	AROCEF Cap.SK+F	500mg/Cap
	AROCEF Susp.SK+F	125mg/5ml
	AROCEF Drop SK+F	100mg/1ml
CEFDINIR	CEDNIR Cap.SK+F	300mg/Cap
	CEDNIR DS Susp.SK+F	250mg/5ml
CEFTRIAXONE	TRIJECT I.M Inj.SK+F	250mg, 500mg and 1gm/vial with 1% lidoaine
	TRIJECT I.V Inj.SK+F	250mg, 500mg and 1gm/vial with water
CEFTIZOXIME		
FLUOROQUINOLONES		
CIPROFLOXACIN	QUINOX Tab.SK+F	250mg,500mg and 750mg/Tab
	QUINOX DS Susp.SK+F	250mg/5ml
LEVOFLOXACIN	XENOXIN Tab.SK+F	250mg,500mg and 750mg/Tab
SPARFLOXACIN	PARLOX Tab.SK+F	
NORFLOXACIN		
GATIFLOXACIN	GATINOX Tab.SK+F	400mg/Tab (film-coated)
BROAD SPECTRUM PENICILLIN		
AMOXYCILLIN	SK-MOX Cap.SK+F	250mg and 500mg/Cap
	SK-MOX Susp.SK+F	125mg/5ml
	SK-MOX DS Susp.SK+F	250mg/5ml
	SK-MOX Drop SK+F	125mg/1.25ml
MACROLIDES AND SIMILAR TYPE		
AZITHROMYCIN	ZITHROX Tab.SK+F	500mg/Tab
	ZITTHROX Susp.SK+F	200mg/5ml
ERYTHROMYCIN	PRIOCIN Tab.SK+F	500mg/Tab
	PRIOCIN Susp.SK+F	125mg/5ml

MEDIUM + NARROW SPECTRUM PENICILLIN		
FLUCLOXACILLIN	FLUCLOXIN Cap.SK+F	250mg and 500mg/Cap
	FLUCLOXIN Susp.SK+F	125mg/5ml
	FLUCLOXIN DS Susp.SK+F	250mg/5ml
DRUG INTERNATIONAL		
GENERIC NAME	**BRAND NAME**	**DOSE**
CEPHALOSPORINS		
CEPHRADINE	DICEF Cap.Drug Inter.	250mg and 500mg/Cap
	DICEF Susp.Drug Inter.	125mg/5ml
	DICEF Drop Drug Inter.	100mg/1ml
	DICEF Inj.Drug Inter.	250mg,500mg and 1gm/vial
CEFIXIME	T-CEF Cap.Drug Inter.	200mg/Cap
	T-CEF Susp.Drug Inter.	100mg/5ml
CEFUROXIME	FUREX Tab.Drug Inter.	250mg and 500mg/Tab
	FUREX Susp.Drug Inter.	125mg/5ml
	FUREX Inj.Drug Inter	250mg and 750mg/vial
CEFPODOXIME	CEFORAN Cap.Drug Inter.	100mg/Cap
	CEFORAN Susp.Drug Inter.	40mg/5ml
CEFADROXIL	SEFANID Cap.Drug Inter.	500mg/Cap
	SEFANID Susp.Drug Inter.	125mg/5ml
CEPHALEXIN	CEFALEX Cap.Drug Inter.	500mg/Cap
	CEFALEX Susp.Drug Inter.	125mg/5ml
CEFTAZIDIME	CEFTRUM Inj.Drug Inter.	250mg,500mg and 1gm/vial
CEFTIZOXIME		
FLUOROQUINOLONES		
CIPROFLOXACIN	CIPROZID-DS Tab.Drug Inter.	500mg/Tab
	CIPROZID-750 Tab.Drug Inter.	750mg/Tab
	CIPROZID Inf.Drug Inter.	200mg in 100ml bot
	CIPROZID Eye Drop Drug Inter.	Ciprofloxacin 0.3% Eye Drop
LEVOFLOXACIN	LEVOFLOX Tab.Drug Inter.	500mg/Tab
	LEVOFLOX Eye Drop Drug Inter.	Levofloxacin 0.5% Eye Drop
SPARFLOXACIN	SPARONEX Tab.Drug Inter.	200mg/Tab
NORFLOXACIN		
OFLOXACIN	OFLACIN Tab.Drug Inter.	200mg and 400mg/Tab
GATIFLOXACIN	GATICIN Tab.Drug Inter.	400mg/Tab (film coated)
PEFLOXACIN	PEFLOX Tab. Drug Inter.	400mg/Tab
BROAD SPECTRUM PENICILLIN		
AMOXYCILLIN	DEMOXIL Cap.Drug Inter.	250mg and 500mg/Cap
	DEMOXIL Susp.Drug Inter.	125mg/5ml
	DEMOXIL Inj.Drug Inter.	250mg,500mg and 1gm/vial
CLAVULANIC ACID		
EPICILLIN		
HETACILLIN		
MACROLIDES AND SIMILAR TYPE		
AZITHROMYCIN	AZIMEX Cap.Drug Inter.	500mg/Cap
	AZIMEX Susp.Drug Inter.	200mg/5ml
CLARITHROMYCIN	CLARIN Tab.Drug Inter.	250mg/Tab

MEDIUM + NARROW SPECTRUM PENICILLIN		
FLUCLOXACILLIN	FLUPEN Cap.Drug Inter.	250mg and 500mg/Cap
	FLUPEN Susp. Drug Inter.	125mg/5ml
	FLUPEN Inj.Drug Inter.	250mg and 500mg/vial
AMINOGLYCOSIDES		
GENTAMICINE	GENTUM E/E Drop. Drug Inter.	Gentamicine 0.3% w/v eye/ear drop
	GENTUM Ear Drop. Drug Inter.	Gentamicine 0.3% w/v eye/ear drop
KANAMYCINE		
AMIKACINE	PSUDONIL Inj. Drug Inter.	250mg/ampoule and 500mg/ampoule;i.m/i.v inj
METACYCLINE		
SANOFI AVENTIS		
GENERIC NAME	**BRAND NAME**	**DOSE**
CEPHALOSPORINS		
CEPHRADINE	SEFRAD Cap.Sanofi Aventis	250mg and 500 mg/Cap
	SEFRAD Susp.Sanofi Aventis	125mg/5ml
	SEFRAD DS Susp.Sanofi Aventis	250mg/5ml
	SEFRAD Drop Sanofi Aventis	100mg/ml
	SEFRAD Inj. Sanofi Aventis	250 g,500 mg and 1 gm/vial;i.m/i.v Inj
CEFUROXIME	SEFUROX Tab.Sanofi Aventis	125mg,250mg and 500mg.Tab
	SEFUROX Susp.Sanofi Aventis	125mg/5ml
	SEFUROX Inj.Sanofi Aventis	750mg/vial
CEFTRIAXONE	ENOCEF Inj.Sanofi Aventis	250mg,500mg and 1gm/vial with lodocaine
	ENOCEF I.V Inj.Sanofi Aventis	250mg,500mg and 1gm/vial with water
CEFTIZOXIME		
FLUOROQUINOLONES		
CIPROFLOXACIN	FIPROX Tab.Sanofi Aventis	250mg,500mg and 750mg/Tab
NORFLOXACIN		
BROAD SPECTRUM PENICILLIN		
AMOXYCILLIN	FIMOXYL Cap. Sanofi Aventis	250mg and 500mg/Cap
	FIMOXYL Tab. Sanofi Aventis	250mg and 500 mg/Tab
	FIMOXYL Susp.Sanofi Aventis	125mg/5ml
	FIMOXYL DS Susp.Sanofi Aventis	250mg/5lm
	FIMOXYL Drop Sanofi Aventis	100mg/1ml
	FIMOXYL Inj.Sanofi Aventis	250mg and 500mg/vial
AMPICILLIN	FICILLIN Cap.Sanofi Avebtis	250mg/cap
	FICILLIN Drop.Sanofi Aventis	125mg/1.25ml
CLOXACILLIN	FICLOX Cap.Sanofi Aventis	500mg/cap
	FICLOX Syp.Sanofi Aventis	125mg/5ml
	FICLOX Paed.Sanofi Aventis	125mg/1.25ml(20 drops)
MACROLIDES AND SIMILAR TYPE		
ERYTHROMYCIN	MACROCIN Tab.Sanofi Aventis	250mg and 500mg/Tab
	MACROCIN Susp.Sanofi Aventis	125mg/5ml
	MACROCIN-T Soln.Sanofi Aventis	Erythromycin BP 2% Soln;Topical preaparation

SPIRAMYCIN	ROVAMYCIN Tab.Sanofi Aventis	3 MIU/ Tab
MEDIUM + NARROW SPECTRUM PENICILLIN		
FLUCLOXACILLIN	FLUXON Cap.Sanofi Aventis	500mg/cap
PENICILLIN V	ORACYN K Tab.Sanofi Aventis	250mg and 500mg/Tab
	ORACYN K Susp.Sanofi Aventis	125mg/5ml
CLOXACILLIN	FICLOX Cap.Sanofi Aventis	500mg/Cap
	FICLOX Syp.Sanofi Aventis	125mg/5ml
	FICLOX Paed.Sanofi Aventis	125mg/1.25ml
AMPICILLIN	FICILLIN Cap.Sanofi Aventis	250mg/cap
	FICILLIN Drop.Sanofi Aventis	125mg/1.25ml

(Shahidi, Ullah Ridwan. 2007, QIMP-14)

CHAPTER 03

OBJECTIVE

AND SIGNIFICANCE

OBJECTIVE OF THE STUDY

The major objectives of this study were:

1. To test the pH profile of different brands of Amoxicillin dry syrup/suspension of some pharmaceutical companies of Bangladesh.
2. To test the sensitivity of different brands of Amoxicillin dry syrup/suspension of some pharmaceutical companies of Bangladesh.

SIGNIFICANCE OF THE STUDY

Amoxicillin contains a β-lactam ring in its structure which undergoes rapid hydrolysis in aqueous solutions. This opens the β-lactam ring of the molecule to produce dibasic penicilloic acid. As a result solutions have a very short life even when refrigerated. So amoxicillin is prepared as a dry salt which is thought to be stable after reconstitution. This reconstituted syrup or suspension should maintain an optimum pH to avoid the breakdown of the β-latam ring. If the syrup or suspension does not maintain an optimum pH then the product will no longer be stable and we know that an unstable product will never give proper therapeutic action. As this syrup/suspension is administered orally so it has to pass through the gastrointestinal tract. Stomach and intestinal pH play an important role in absorption of medicament. Poor absorption leads to poor bioavailability and finally leads to poor or sub-therapeutic action of a drug. So, to check the stability of reconstituted syrup/suspension we performed pH profile test of different brands of amoxicillin trihydrate dry syrup and suspension of big, medium and small pharmaceutical companies of Bangladesh.

Amoxicillin is a broad spectrum antibiotic that is active against both gram positive and gram negative bacteria. It is active against a common gram negative bacteria *Escherichia coli* which is responsible for common infections of the body. In this study, test of sensitivity of amoxicillin dry syrup and suspension was performed to determine the bactericidal action of amoxicillin against *E.coli*. If the reconstituted preparation is not sensitive then it will not give proper therapeutic action to the patients. Due to poor sensitivity of the syrup/suspension the bacteria might become resistant to the drug.

In this study we tried to find out the stability (pH profile) and sensitivity of available amoxicillin dry syrup or suspension in Bangladesh. According to our knowledge there is no current study has been carried out to determine the pH profile and sensitivity of reconstituted amoxicillin dry syrup/suspension of different pharmaceutical companies of Bangladesh. This study will help to evaluate the pH profile and sensitivity of amoxicillin dry syrup/suspension of different pharmaceutical companies of Bangladesh and will ultimately help the health sector to select the appropriate medicine.

CHAPTER 04

MATERIALS AND METHOD

MATERIALS AND METHOD

.1 **RESEARCH DESIGN**: The study was a laboratory based study in which 16 ifferent brands of Amoxicillin Dry Syrups/Suspensions were collected from Dhaka and eni.

.2 **PLACE OF STUDY**: Laboratory of East West University

.3 pH PROFILE TESTING:

he purpose of pH profile testing is to asses the effects of temperature, humidity, light nd other environmental factors on the quality of a drug substance. The pH of a drug olution may have a very dramatic effect on its stability. Depending on the reaction echanism, a change of more than 10 fold in rate constant may result from a shift of just ne pH unit. When drugs are formulated in solution it's essential to construct a pH versus ate profile so that the optimum pH for stability can be located. **(Banker, S. Gilbert, 002)**

.3.1 MATERIALS REQUIRED:

- Amoxicillin dry syrup/suspension (100ml)
- Distilled Water
- Buffer Solution
- pH meter
- Refrigerator
- Beaker
- Measuring Cylinder

.3.2 METHOD:

.3.2.a PREPARATION OF AMOXICILLIN DRY SYRUP/SUSPENSION:

1. Distilled water was measured in the measuring cylinder according to the volume mentioned on the pack of different brands of amoxicillin syrup/suspension to prepare 100 ml.

2. Distilled water was added to the bottle of dry syrup/suspension and the bottle was shaken to get the syrup/suspension that can be used to test the stability (pH profile).

4.3.2.b CALIBRATION OF APPARATUS:

The apparatus (pH meter) is calibrated with standard buffer solutions to check the linearity of the response of the electrode at different pH values and to detect a faulty glass electrode.

4.3.2.c STANDARD BUFFER SOLUTIONS

Standard buffer solutions are used in the determination of pH values. They are prepared with carbon-dioxide-free water R. They should be stored in bottles of chemically resistant glass or in bottles made of polyethylene.

Unless otherwise specified, standard buffer solutions should not be used later than 3 months after preparation. If growth of microorganisms starts in the solutions they should immediately be discarded and the bottles thoroughly cleaned and sterilized before refilling. **(WHO Pharmacopoeia Library)**

4.3.2.d TESTING pH OF RECONSTITUTED AMOXICILLIN DRY SYRUP/SUSPENSION:

1. 10 ml reconstituted syrup/suspension was taken in a sterilized beaker.
2. The pH meter was dipped into the beaker containing syrup/suspension.
3. When the pH meter showed a stable value on its screen, it was removed from the beaker.
4. The pH meter was then dipped into distilled water and then into standard buffer solution.
5. The pH meter was then turned off.
6. The reconstituted syrup/suspension was kept in the refrigerator for 7 days.
   The pH value of this syrup/suspension was measured for 7 days.

4.4 SENSITIVITY TESTING OF AMOXICILLIN DRY SYRUP/SUSPENSION:

The sensitivity of antibiotic content in samples can be determined by chemical, physical and biological means. An assay was made to determine the ability of an antibiotic to kill or inhibit the growth of microorganisms. Biological tests offer the most convenient mean of making an assay.

4.4.1DISK-DIFUSSION METHOD:

The paper-disk diffusion method is the most commonly used technique for determining sensitivity of microorganism to antibiotics. Small paper disks impregnated with antibiotics are placed upon the surface of an inoculated plate. After incubation, the plates are observed for any zones of inhibition surrounding the disks. A zone of inhibition around the disk indicates that the organism was inhibited by the drug, which diffused into the agar from the disk. **(Michael J. Pelczar, 2004)**

In this study amoxicillin dry syrup and suspension is used (as the antibiotic) whose sensitivity is determined by performing zone of inhibition test against *E.coli* bacteria. Amoxicillin is a broad spectrum antibiotic which is active against both gram positive and gram negative bacteria. *E.coli* is a gram negative bacterium against which amoxicillin shows better activity. For this reason we used *E.coli* to test the sensitivity of reconstituted amoxicillin syrup/suspension.

4.4.1.a MATERIALS REQUIRED:

- Amoxicillin Dry Syrup/Suspension (100 ml)
- McConkey Agar
- Normal Saline water
- Distilled water
- *E.coli*

- Petri dish
- Agar preparation bottle.

- Measuring Cylinder
- Beakers
- Screw test tube
- Micropipettes
- Inoculating loop
- Cotton swab
- Paper disks
- Forceps
- Papers
- Aluminum foil

- Hot air oven
- Auto clave
- Incubator
- Laminar air flow cabinet
- Refrigerator
- Balance machine
- Bunsen burner

4.4.1.b METHOD:

PREPARATION OF AGAR:

1. Specific amount of McConkey Agar powder was measured in the weighing machine and then placed in the agar preparation bottle.
2. Specific volume of water was measured in the measuring cylinder and then added into the agar containing bottle.
3. The bottle was agitated to mix the agar with the water properly.
4. This bottle was then placed in the Auto Clave. Here 125 atm pressure was maintained for 15 minutes.
5. After reaching 125 atm pressure the machine was stopped and allowed to lower the pressure until it reaches 0 atm pressure.
6. The agar was ready to be used in the agar plate.

STERILIZATION OF APPARATUSES:

1. Petri dishes were covered with paper and placed in the hot air oven for 30 minutes at 150° Celsius.
2. Forceps (covered with aluminum foil), normal saline water, screw test tube, tips, cotton buds, paper disks were placed in the autoclave.
3. After sterilization all these materials were cooled and placed in the laminar air flow cabinet.

RECONSTITUTION OF AMOXYCILLIN DRY SYRUP/SUSPENSION:

Amoxicillin Dry Syrup/Suspension of different brands was prepared according to the instruction written on their pack.

PREPARATION OF PETRI DISH WITH AGAR and *E.coli*:

1. All the petri dishes were marked with a marker so that a single Petri dish contained an amoxicillin disk of specific brand.
2. Previously prepared McConkey agar was poured in to the Petri dishes.
3. The dishes were allowed to cool so that the agar can became solid.
4. In the screw test tube normal saline was taken with micropipettes and tips. Then with the help of inoculating loop *E.coli* (freshly grown) was added in this saline and the test tube was shaken to mix the saline water and *E.coli*
5. With the help of sterilized cotton buds the saline and *E.coli* mixture was spread on the surface of solidified agar.
6. Paper disks were impregnated with reconstituted dry syrup/suspension and with the help of forceps these were placed on the marked Petri dishes.
7. All the Petri dishes were placed (upside down) in the incubator and kept there for 24 hours.
8. After 24 hours the Petri dishes were taken from the incubator and the diameter of zone of inhibition around the disks were measured with the help of scale.

Reports from the laboratory providing results of the standard single-disk susceptibility test should be interpreted according to the following criteria:

Microorganism	Zone Diameter (mm)
E. coli ATCC 25922	16 to 22
H. influenzae ATCC 49247h11	13 to 21
S. aureus ATCC 25923	27 to 35

(Schrefer, John. 2000)

SAMPLES USED FOR TESTING pH AND SENSITIVITY OF AMOXICILLIN DRY SYRUP/SUSPENSION:

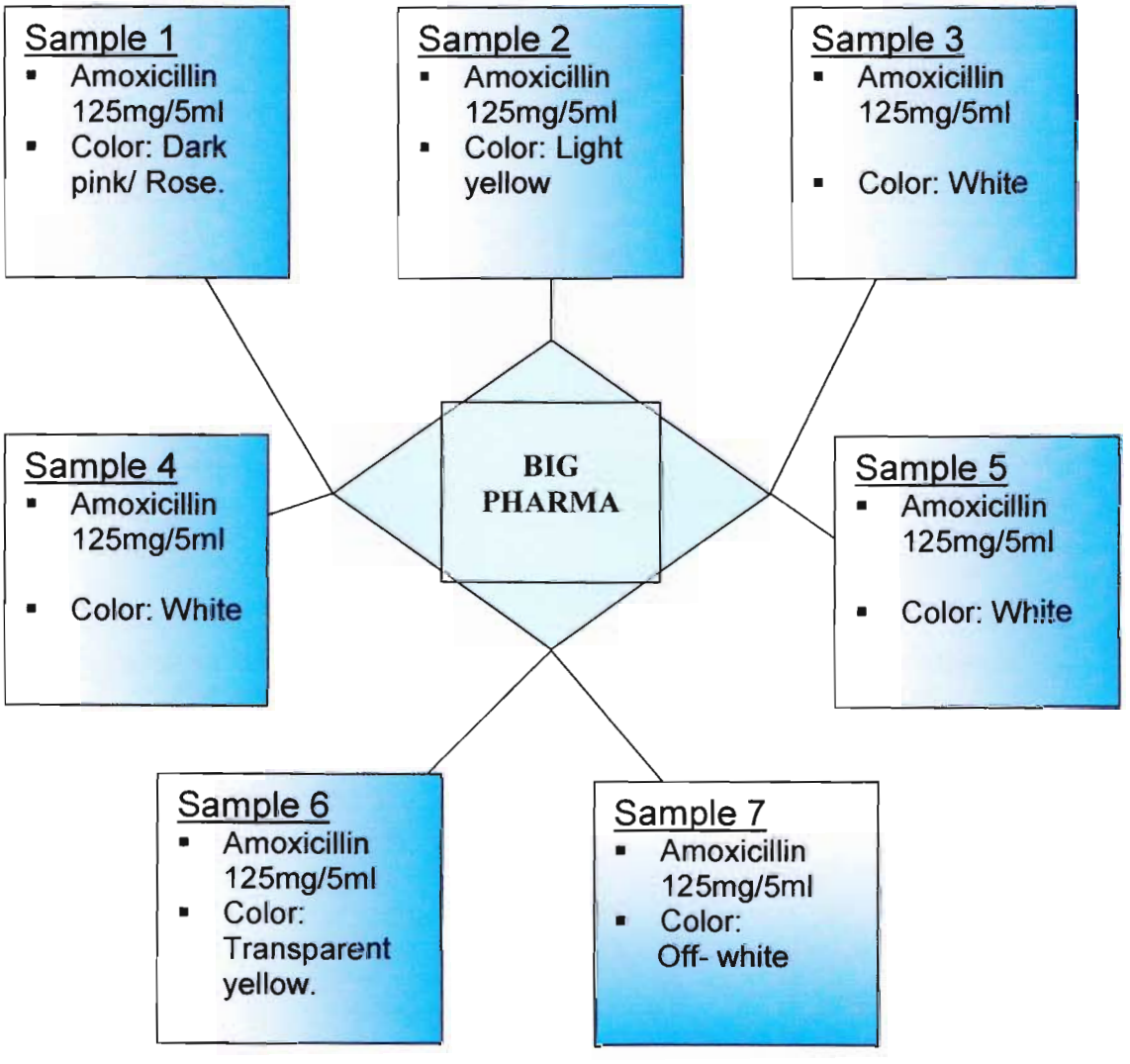


Figure14: Different brands of amoxicillin dry syrup/suspension of Big Pharmaceuticals used as samples for testing pH and sensitivity

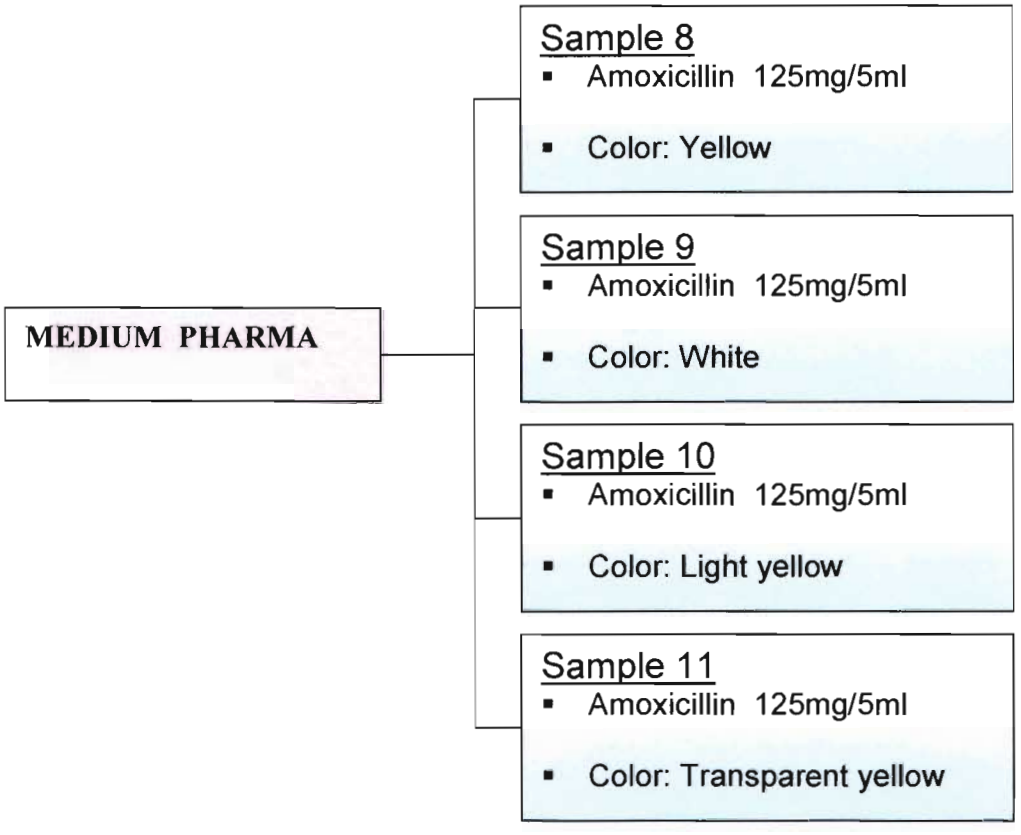


Figure 15: Different brands of amoxicillin dry syrup/suspension of Medium Pharmaceuticals used as samples for testing pH and sensitivity

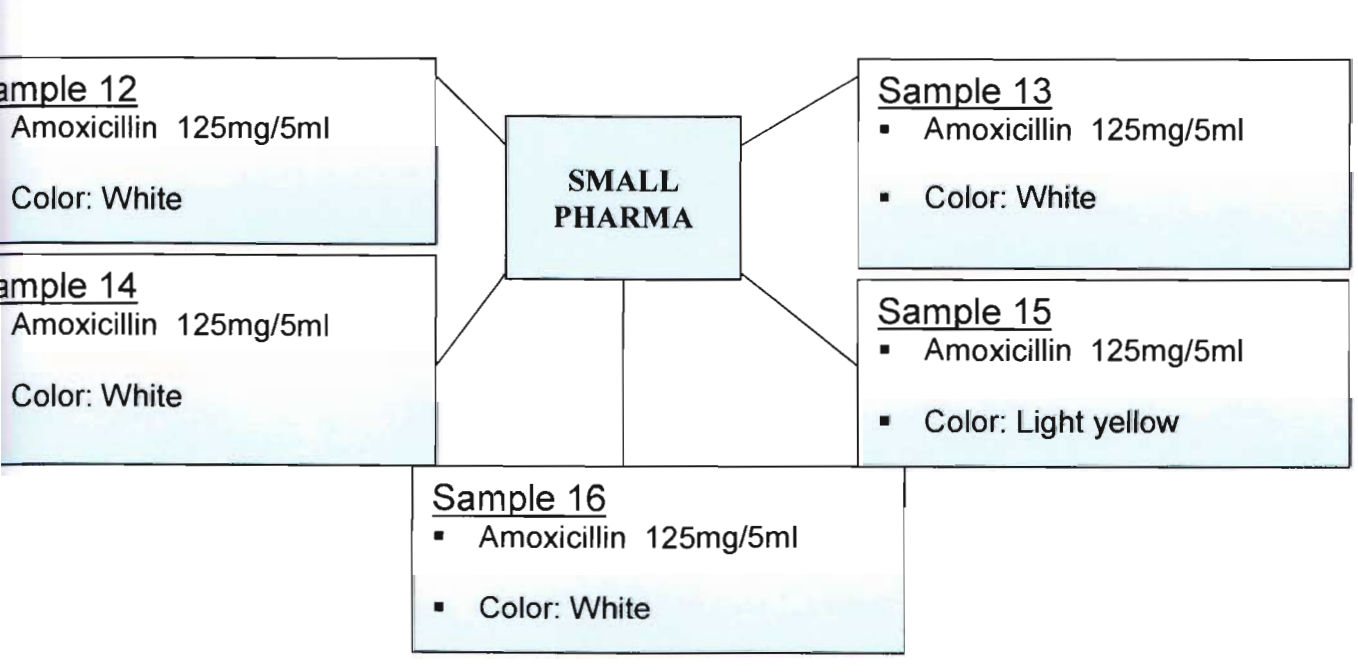


Figure 16: Different brands of amoxicillin dry syrup/suspension of Small Pharmaceuticals used as samples for testing pH and sensitivity

CHAPTER 05

RESULT

RESULT

5.1 RESULT OF pH TEST:

Experiment	Sample	pH Values
Testing pH values of Reconstituted dry syrup/suspension	Sample 1	6.4
	Sample 2	5.3
	Sample 3	6.1
	Sample 4	3.7
	Sample 5	6.2
	Sample 6	5.6
	Sample 7	5.7

Table1: Different brands of Amoxicillin dry syrup/suspension of Big Pharmaceutical Companies (S1-S7)

Out of 7 reconstituted Amoxicillin dry syrup/suspension of big pharmaceutical companies, 6 showed pH values within the range (4.0-7.0). **(British Pharmacopoeia, 2004).** Samples 1, 3, 5 showed pH values above 6 and sample 2, 6, 7 showed pH values above 5. Only sample 4 showed a pH value below the range.

Experiment	Sample	pH Values
Testing pH values of Reconstituted dry syrup/suspension	Sample 8	5.5
	Sample 9	5.4
	Sample 10	3.9
	Sample 11	3

Table 2: Different brands of Amoxicillin dry syrup/suspension of Medium Pharmaceutical Companies (S8-S11)

Out of 4 reconstituted Amoxicillin dry syrup/suspension of medium pharmaceutical companies, 2 (sample8 and sample9) showed pH values within the range (4.0-7.0) **(British Pharmacopoeia, 2004)**. Sample 10 and 11 showed a pH value below the range which is 3.9 and 3 respectively.

Experiment	Sample	pH Values
Testing pH values of Reconstituted dry syrup/suspension	Sample 12	5.4
	Sample 13	6
	Sample 14	5.6
	Sample 15	4.7
	Sample 16	5.8

Table 3: Different brands of Amoxicillin dry syrup/suspension of Small Pharmaceutical Companies (S12-S16)

All 5 reconstituted Amoxicillin dry syrup/suspension of small pharmaceutical companies showed pH values within the range(4.0-7.0) **(British Pharmacopoeia, 2004)**. Sample 12, 13, 14 and 16 showed pH values above 5 and sample 15 showed a pH value above 4.

5.2 RESULT OF SENSITIVITY TEST:

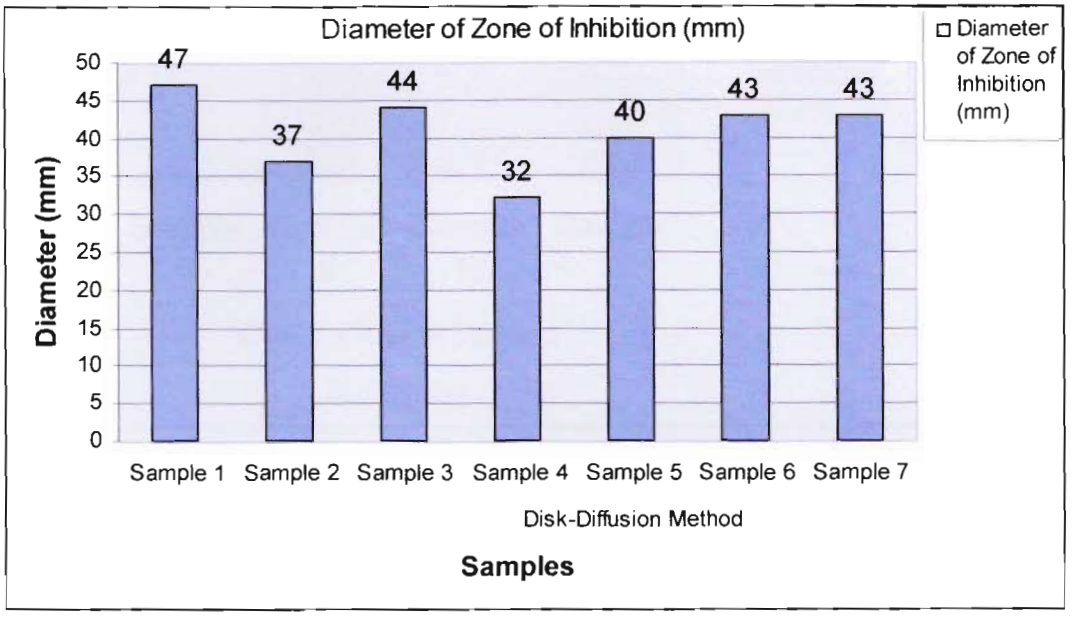


Figure 17: Zone of inhibition of Different Brands of Amoxicillin Dry Syrup/Suspension of Big Pharmaceutical Companies (S1 to S7)

All 7 Amoxicillin dry syrup/suspension of Big Pharmaceuticals showed acceptable zone of inhibition against *E.coli* bacterial strain. Sample 1, 3, 5, 6 and 7 showed the zone of inhibition above 40mm, whereas sample 2 and 4 showed the zone above 30mm.

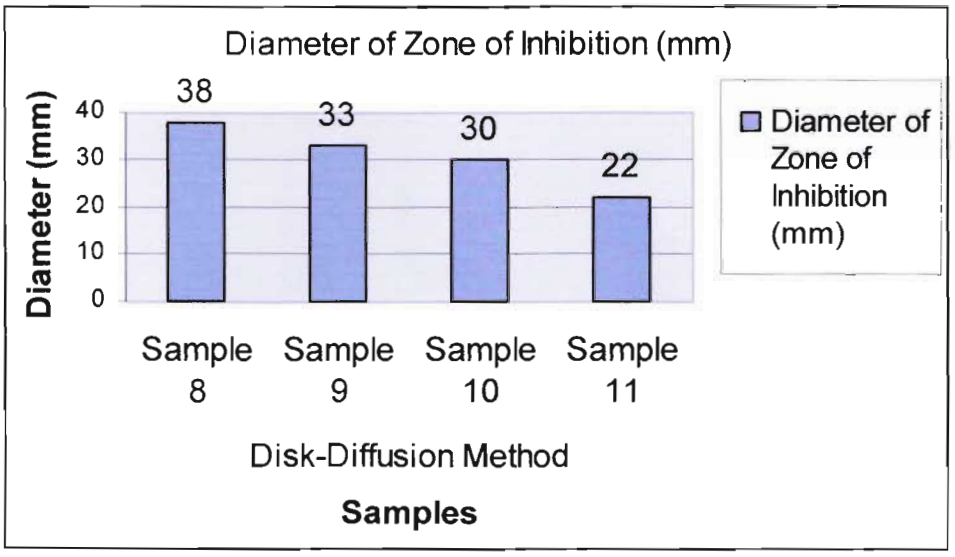


Figure 18: Zone of inhibition of Different Brands of Amoxicillin Dry Syrup/Suspension of Medium Pharmaceutical Companies (S8 to S11)

All 4 Amoxicillin dry syrup/suspension of Medium Pharmaceuticals showed acceptable zone of inhibition against *E.coli* bacterial strain. Sample 8, 9 and 10 showed the zone of inhibition above 30mm. Only sample 11 showed the zone at 22mm.

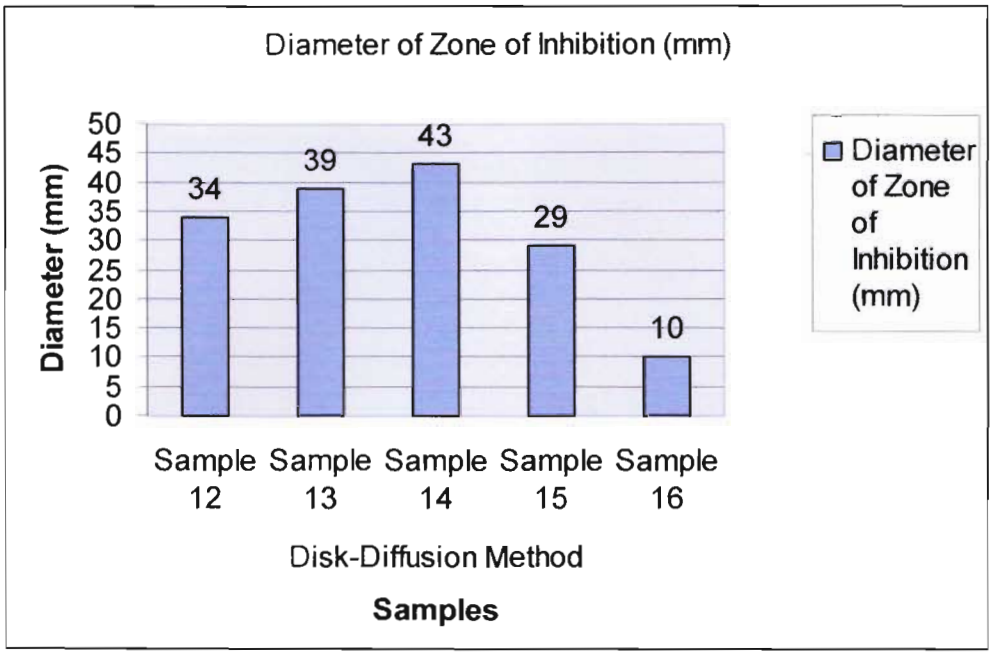
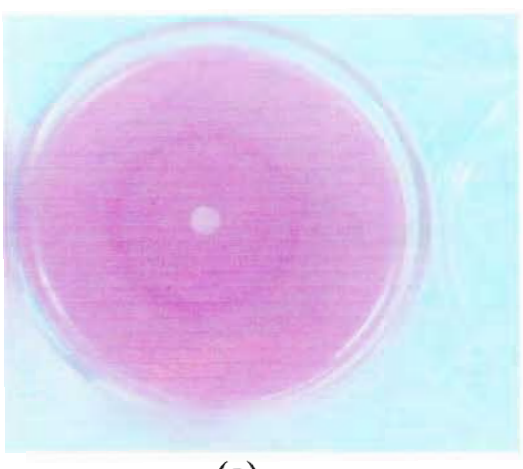


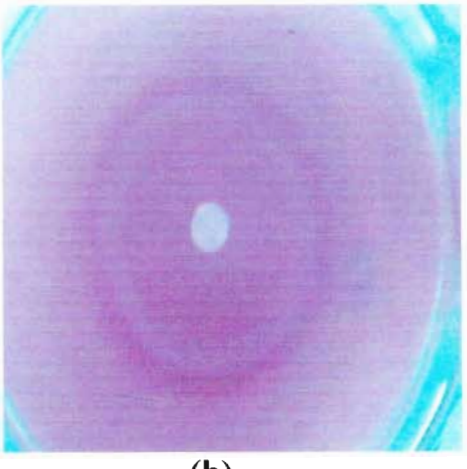
Figure 19: Zone of inhibition of Different Brands of Amoxicillin Dry Syrup/Suspension of Small Pharmaceutical Companies (S12 to S16)

Out of 5 different brands of Amoxicillin dry syrup/suspension of Small Pharmaceuticals 4 samples showed acceptable zone of inhibition against *E.coli* bacterial strain. Only sample 16 showed a poor zone of inhibition (10mm).

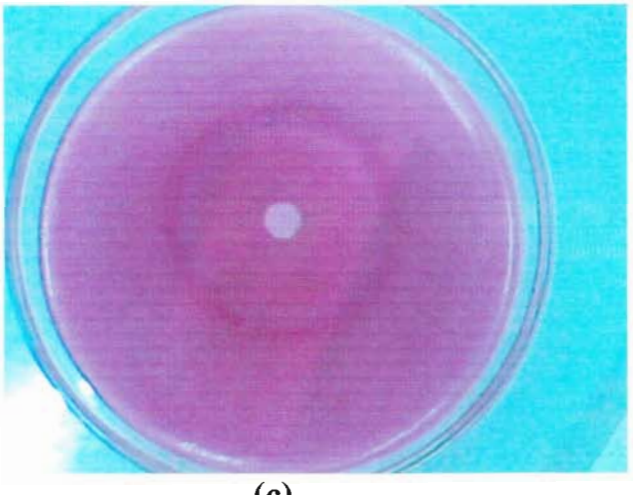
FIGURES



(a)



(b)



(c)

FIGURE 20: Images of Zone of inhibition showed by different Samples

[(a) =Sample of Big Pharmaceuticals
(b)= Sample of Medium Pharmaceuticals
(c)= Sample of Small Pharmaceuticals]

CHAPTER 06

DISCUSSION
And CONCLUSION

DISCUSSION

pH of amoxicillin syrup/suspension of 6 big, 2 medium and 5 small pharmaceutical panies is within the range that complies with the Pharmacopoeia. The zone of bition in reconstituted syrup/suspension of 7 Big, 4 Medium and 4 Small rmaceutical companies is within the acceptable range.

st of the syrup/suspension showed better stability by maintaining a pH value within range (4.0-7.0) **(British Pharmacopoeia, 2004)**. Syrup/suspension from big, medium small pharmaceutical companies showed acceptable zone of inhibition against *E.coli* terial strain.

pharmaceutical sector in Bangladesh, one of the fastest growing sectors of the nomy, is poised to transform the country into a global hub of quality medicines. rmaceutical industries in Bangladesh are gifted with unparalleled potential to grow in days ahead as they enjoy a number of competitive advantages. The industry's ability comply with guidelines of quality assurance has put it on a solid base. One of the or positive impacts of Drug (Control) Ordinance is the rapid development of local nufacturing capability. Almost all types of possible dosage forms include tablets, sules, oral and external liquids (solutions, suspensions, emulsions), ointments, creams, ctions (small volume ampoules/dry fill vials/suspensions and large volume IV fluids), aerosol inhalers are now produced in the country. A most remarkable progress the l industry has made in recent time is the phenomenal increase in the local production basic chemicals. There are now 13 drug manufacturing units, which also manufacture ain basic materials. Amoxicillin Trihydrate manufacturing is one of those.

oxicillin is available as tablet, capsule, dry syrup/suspension form. But the most le dosage form is thought to be the dry syrup/suspension form. Amoxicillin oral pension or syrup comes as dry powder which is reconstituted with suitable amount of er. After reconstitution the syrup/suspension is desired to be stable by maintaining an mum pH. On the other hand amoxicillin is indicated for some common infections sed by *E.coli*. So, the reconstituted syrup/suspension must be sensitive. If the

pension does not maintain sensitivity, then *E.coli* will become resistant to the as a result amoxicillin will not give proper therapeutic action against *E.coli.*

lin dry syrup and suspensions were collected from different drug stores of ıd Feni (Noakhali). Some of these syrups/suspensions were of renowned big ɛutical companies and some were of medium, small pharmaceutical companies. ı of this study was to test the pH profile and sensitivity of these ıspensions.

table pH for reconstituted amoxicillin syrup/suspension is 4.0-7.0. **(British copoeia, 2004).** One study showed that the heavily substituted beta-lactams are nder physiological conditions including in the presence of enzymes of the ɛ tract. The beta-lactams were unstable in base. At pH 11.3 and 37° C they were ɛd with half-lives of 1.5-2 h. **(Knight, Green. et al, 1992)**. Our results showed ut of 7 samples of big pharmaceutical companies, 2 out of 4 samples of medium ɛeutical companies and all 5 samples of small pharmaceutical companies showed es within the range and proved to be stable formulations.

ɛe to penicillin occurs by the decreased activity of β-lactamases, the binding of ɒiotic to target penicillin-binding proteins (PBPs), possible efflux mechanisms, or embrane permeability, especially in gram-negative bacteria. One study that was ɒut with amoxicillin and *H. pylori* isolates showed that *H. pylori* isolates sistant to amoxicillin. The amoxicillin resistance was associated with minimal idal concentration/MIC ratios indicating that *H. pylori* bacteria resistant to llin demonstrated a tolerance to the antibiotic. **(Maria P. Dore, et al, 1999).** Our ıowed that the zone of inhibition by different brands of reconstituted amoxicillin suspensions within the acceptable range. The reconstituted syrup or suspensions harmaceuticals as well as medium/small companies showed better sensitivity and ɛo be a sensitive drug in treating infections caused by *E.coli.*

CONCLUSION

Amoxicillin is a common antibiotic used for the treatment of different common infections. As the syrup/suspension comes as dry form so it can be said that it is a sensitive preparation. After reconstitution with suitable amount of water the syrup/suspension becomes ready for administration. It is important for the reconstituted syrup/suspension to maintain an optimum pH to remain stable. Undesired fluctuation in the pH values indicates instability of the preparation. Instability of the preparation may be due to manufacturing error, environmental effect, improper storage etc. So by this study we tried to find out the pH profile of locally available amoxicillin syrup/suspension. From the result of the study it was found that most of the reconstituted dry syrup/suspension of big, medium and small pharmaceutical companies showed a pH values within the acceptable range. This indicates that the amoxicillin dry syrup/suspensions which are available in the local market of Bangladesh are mostly stable preparations.

Amoxicillin is active against gram negative bacteria so it shows its action against infections caused by *Escherichia coli*. By this study we tried to find out the sensitivity of amoxicillin syrup/suspension of big, medium and small pharmaceuticals of Bangladesh against *E. coli*. After completion of the study we found that majority of the dry syrup/suspensions showed a zone of inhibition within the acceptable range. So, we can say that these dry syrup/suspensions also proved to be a sensitive drug which is successfully showing its action against *E.coli* bacteria. So, this drug can be indicated for treating infections caused by this gram negative bacterium.

In conclusion we can say that despite of being developing country, pharmaceutical companies of Bangladesh produce many quality pharmaceutical preparations. According to our knowledge there is no current study that has been carried out to test the pH profile of reconstituted amoxicillin dry syrup/suspension. By this study, we tried to out find the pH profile and sensitivity of different brands of amoxicillin dry syrup/suspension of some pharmaceuticals of Bangladesh. Our study will help both the pharmaceutical sector and

general people of Bangladesh to get an idea about the sensitivity and pH profile of existing amoxicillin dry syrup/suspension. Further studies are needed to establish the detailed stability profile and sensitivity of amoxicillin dry syrup/suspension against a wide range of bacteria.

CHAPTER 07

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