G. PULLA REDDY COLLEGE OF PHARMACY
ONLINE COURSE
on
BIOAVAILABILITY & BIOEQUIVALENCE
ENHANCEMENT OF BIOAVAILABILITY

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SECTION 1: OPEN EDUCATION RESOURCE

About the OER:
The Open Education Resource is a collection of Lesson activities in Wordpress that are useful as out-of-class activity while flipping the classroom.

There are 2 lessons as part of this OER, and each deals with an aspect related to

1) **Bioavailability and Bioequivalence, Bioavailability and Bioequivalence Protocol**
2) **Bioavailability enhancement methods**

- OER is downloadable from: Wordpress webpage: [https://1032group2.wordpress.com/](https://1032group2.wordpress.com/)

- **Target Audience**: B. Pharmacy III year and Final year students

- **Tags & Key words**: Bioavailability, Bioequivalence, Experimental Design, Assessment methods for bioavailability, Statistical interference, Methods for enhancement of bioavailability and approaches etc.,

- OER developed in [https://1032group2.wordpress.com/](https://1032group2.wordpress.com/)

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LEARNING OBJECTIVES

After using this OER, learner will be able to:

**Lesson 1**

**Part-I**

1. Basic terminologies used in Bioavailability and Bioequivalence
2. Objective of Bioavailability study

**Part-II**

1. Bioavailability & Bioequivalence
2. Testing Protocol and Procedure
3. Experimental Design
4. Single Dose Versus Multiple Dose Bioavailability studies
Part-III

1. Measurement of Bioavailability/ Methods of assessment of Bioavailability
   I) Indirect methods or Pharmacokinetic methods:
       - Plasma Data
       - Urine Data
   II) Direct methods or Pharmacodynamic methods:
       - Clinical Response
       - Therapeutic activity

2. Statistical Analysis of the data
   1) Hypothesis testing (ANOVA & TOST (Interval based))
   2) Confidence interval approach

Lesson 2

Part-I

1. Introduction
2. BCS Class
3. Bioavailability enhancement methods.
   - Enhancement of drug solubility or dissolution rate.
   - Enhancement of drug permeability
   - Enhancement of drug stability
   - Enhancement of gastrointestinal retention

Part-II

1. Enhancement of drug solubility or dissolution rate & Various methods

Part-III

1. Enhancement of drug permeability
2. Enhancement of drug stability
3. Enhancement of gastrointestinal retention

Helpful Documentation for Tool Use

1. For design & development of lesson activity in Wordpress.com
2. Videos preparation tools Screen-O-Matic (https://screencast-o-matic.com/) Screen Casts/MS-Power point presentations
3. Google forms for Quiz
SECTION 2: DESIGN DECISIONS

Nature of Decisions taken

The design decisions involved in the creation of this OER were of broadly three types:

1. Content Decisions
2. Pedagogic Decisions
3. Technology Decisions

Content Decisions

The content decisions related to:

1. **Lesson wise : Areas to be covered were identified**: Bioavailability and Bioequivalence, Methods for enhancement of Bioavailability
2. Decided on the Videos /MS- Power point presentations to be provided for out of class activity and in class activity
3. NPTEL & Other resources like YouTube on the topic, Question bank, Think-Pair-Share activity and Assignments

Pedagogic Decisions

- Typically in a flipped classroom strategy, there are two segments
  - Out-of-class segment and
  - In-Class segment
- Decisions were taken on the material to be provided for the out class activity. (Videos/MS-Power point presentations) to understand/ to get an overview on the topic to be covered in the class.

In terms of concept marking the pedagogic decisions that were taken for the Out-of-class segment related to:

a. **Cognitive Levels** of Questions to be asked along with the resources
   - Mostly Recall to Apply level question for out of class and Create Level question for In-class activity covering the Blooms higher level: Analyze, Create & Evaluate

b. **Assessment Strategies**: Through assignments to meet the learning outcomes
Out of class activity: Giving questions based on the videos and ask them to submit before coming to class. (Blooms Level: Understand & Recall)

1. Lesson-1: Bioavailability (BA) and Bioequivalence (BE) concept, BA & BE protocol, its assessment methods and statistical interpretation etc.,

Video links:
Lesson 1- Bioavailability & Bioequivalence Part I
https://youtu.be/18cRPU5q_j0

Lesson 1- Bioavailability & Bioequivalence Part II-1
https://youtu.be/qCkw5Y7yvzc

Lesson 1- Bioavailability & Bioequivalence Part II-2
https://youtu.be/1YeVFLb-TJ8

Lesson 1- Bioavailability & Bioequivalence Part III-1
https://youtu.be/l3C3o-cYhhE

Lesson 1- Bioavailability & Bioequivalence Part III-2
https://youtu.be/2EfrBURcRWI

2. Lesson-2: Enhancement of Bioavailability- Methods for enhancement of Bioavailability

Lesson-2- Enhancement of Bioavailability -Part-I
https://youtu.be/4Y036jyQIQs

Lesson-2- Enhancement of Bioavailability -Part-II
https://youtu.be/q3xIT37dJbU

Lesson-2- Enhancement of Bioavailability -Part-III
https://youtu.be/GT1GgoXGoJw
In Class activity: (Blooms level: Analyze, Create & Evaluate)

Lesson 1 & Lesson 2:

Active learning strategy: Bioavailability protocol, Enhancement of Bioavailability

Learning Objectives

1. Students are able to learn, write bioavailability terminologies

2. Students will be able to prepare experimental design and basic protocol for various dosage forms

3. Various approaches for enhancement of Bioavailability

Active learning strategy: Experimental Design

- Presenting students with a experimental design in class
- Providing some model design or guidance towards preparing the design
- At the end of the design with a final outcome or solution with reference to learning objectives

The topic is divided into following categories and the teacher divides the students as per the following:

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step:1</td>
<td>Students are divided into a group of 3 or 6. The group should be diverse in terms of gender, ability and skill.</td>
</tr>
<tr>
<td>Step:2</td>
<td>There are two lessons with 6 parts</td>
</tr>
<tr>
<td>Step:3</td>
<td>Each student is assigned 1 or 2 parts to learn. Each student should learn and discuss with the group</td>
</tr>
<tr>
<td>Step:4</td>
<td>Students should be familiar with videos.</td>
</tr>
<tr>
<td>Step:5</td>
<td>Students come back to their group and present their videos in group, given time to discuss the points of their videos.</td>
</tr>
</tbody>
</table>
**Technology Decisions**

While developing the Out-of-Class and In-class activities, the major technology decisions taken were:


b. MS- Power point presentation

c. Wordpress Lesson Activity for setting up Out-of-Class segment as it allowed guided self-learning through [wordpress.com](https://1032group2.wordpress.com/)