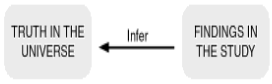
Research designs and Methods

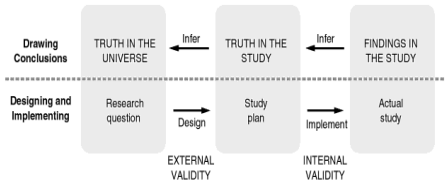
Sinaa Alaqeel MSc, PhD
Assistant Professor
Clinical Pharmacy Department
College of Pharmacy
King Saud University
Salageel@ksu.edu.sa

Definition of Research

Research is one of the ways to find answers to your questions using unbiased, valid, and reliable procedures and techniques.



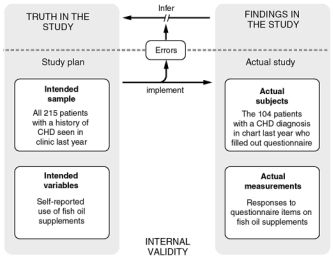
The process of research

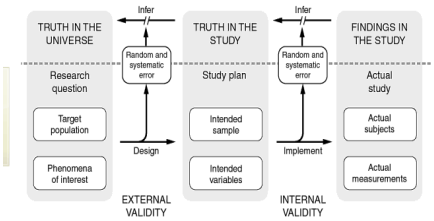


Definition of Research

Research is one of the ways to find answers to your questions using unbiased, valid, and reliable procedures and techniques.

Implementation errors

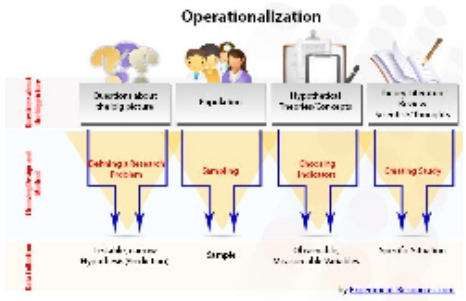


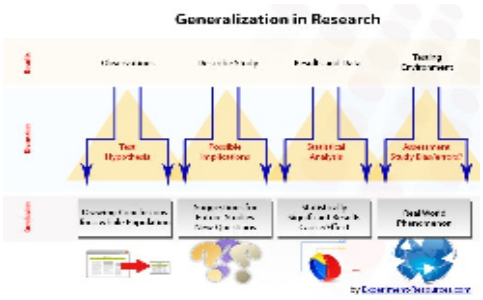


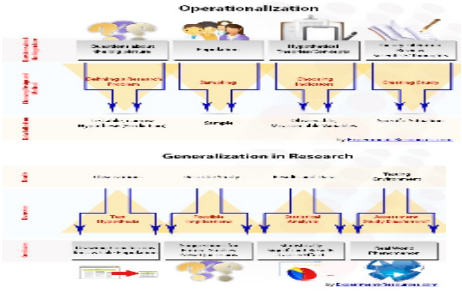
The research process

The Research Process Steps

1. Formulating a research question
2. Conceptualizing a research design
3. Constructing an instrument for data collection
4. Selecting a sample
5. Writing a research proposal
6. Collecting data
7. Processing data
8. Writing a research report







What is GOOD research?

Novelty and Originality

- Never done before
- Advance our knowledge and understanding

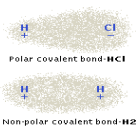
Enough? Anything else?

Good research: Generalization

- DNA structure (James Watson & Francis Crick, Nobel Laureate 1962)
  - Genetic code for all living organisms
  - Explain replication and protein synthesis

Good research: Prediction

- Chemical bonding and forces between molecules (Linus Pauling, Chemistry Nobel Laureate 1954)
  - Predict molecular interactions and chemical reactions



Good research: Wide application

- Polymerase Chain Reaction (Kary Mullis, Nobel Laureate in chemistry 1993)
  - Make 1 million copies of DNA within hours
  - Wide application in medicine, forensic sciences, molecular…..

Good research: Wide application

- Fiber optics (Charles Kao and George Hockham, 1967)
  - Light loss in glass fiber due to scattering and absorption of impurities
  - Lead to the development of silica fiber of speeding up transmission of signals and lowering energy requirements

Vital elements of good research

- Originality & Novelty
- Able to make generalization
- Able to make prediction
- Wide application

Ask yourself this question:
"*How about my own research project*?"

Just get out and do it !

The Research Process Steps

1. Formulating a research question
2. Conceptualizing a research design
3. Constructing an instrument for data collection
4. Selecting a sample
5. Writing a research proposal
6. Collecting data
7. Processing data
8. Writing a research report

Research questions should guide your:

- Formulation of a Research Rationale & Proposal
- Aims and objectives
- Literature search
- Decisions about:
  - What kind of research strategy & design to employ
  - What data to collect and from whom?
  - How to analyse the data
- Writing up your project (i.e. stop you from going off in unnecessary directions and tangents)

The Research Process Steps

1. Formulating a research question
2. Conceptualizing a research design
3. Constructing an instrument for data collection
4. Selecting a sample
5. Writing a research proposal
6. Collecting data
7. Processing data
8. Writing a research report

- **Methodology:** the general principles of investigation that guide a study. Quantitative , qualitative.
- **Design:** the overall plan and structure of of a piece of research. Operational aspects of the study. E.g. controlled, cohort, case study
- **Methods:** specific techniques employed in execution of a piece of research. E.g. sampling methods, data collection instruments.

Types of Research

Discovery (Fact findings)

- Which species of fish is most sensitive to cadmium?
- What is the optimal temperature and pH for crystalizing compound A?
- How many compounds are in the seeds and leaves of Foeniculum vulgare ?

Molecules. 2011 Feb 1;16(2):1366-77.

Chemical composition, antimicrobial and antioxidant activities of essential oils from organically cultivated fennel cultivars.

Shahat AA, Ibrahim AY, Hendawy SF, Omer EA, Hammouda FM, Abdel-Rahman FH, Saleh MA.

Department of Phytochemistry, Production of Medicinal and Aromatic Plants, National Research Centre (NRC), 12311 Dokki, Cairo, Egypt.

Abstract

Essential oils of the fruits of three organically grown cultivars of Egyptian fennel (Foeniculum vulgare var. azoricum, Foeniculum vulgare var. dulce and Foeniculum vulgare var. vulgare) were examined for their chemical constituents, antimicrobial and antioxidant activities. Gas chromatography/mass spectrometry analysis of the essential oils revealed the presence of 18 major monoterpenoids in all three cultivars but their percentage in each oil were greatly different. trans-Anethole, estragole, fenchone and limonene were highly abundant in all of the examined oils. Antioxidant activities of the essential oils were evaluated using the DPPH radical scavenging, lipid peroxidation and metal chelating assays. Essential oils from the azoricum and dulce cultivars were more effective antioxidants than that from the vulgare cultivar. Antimicrobial activities of each oil were measured against two species of fungi, two species of Gram negative and two species of Gram positive bacteria. All three cultivars showed similar antimicrobial activity.

Technique development

- Lower the detection limit of chemical
- New/more user friendly program for faster calculation
- Improve the resolution of microscope / image recognition/telescope

J Chromatogr A. 2008 Aug 22;1202(2):224-8. Epub 2008 Jul 11.

Optimization of an electrolyte system for analysis of ethambutol in pharmaceutical formulations by capillary zone electrophoresis using complexation with copper(II).

Faria AF, de Souza MV, Bruns RE, de Oliveira MA.

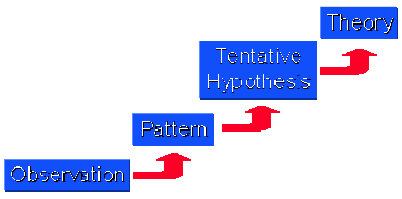
Departamento de Química, Instituto de Ciências Exatas, Universidade Federal de Juiz de Fora, Cidade Universitária, CEP 36036-330, Juiz de Fora, MG, Brazil.

Abstract

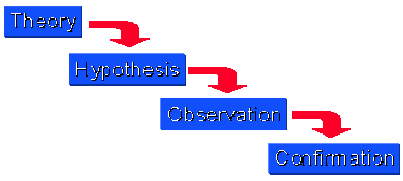
An alternative methodology for the determination of ethambutol by capillary zone electrophoresis (CZE) under direct UV detection at 262 nm, using acetic acid/sodium acetate buffer solution (pH 4.6) containing copper(II) sulphate to form the ethambutol-copper(II) complex, within analysis time of 2.5 min is proposed. The optimum CE conditions for the background electrolyte were established performing experiments of a 3 (2) factorial design. Complex formation was evidenced by the UV batochromic shift and the [CuETB](0) and [CuETB](2+) chemical structures were indicated by LC-MS analysis. After some validation parameters have been performed, such as linearity (r=0.999), selectivity (comparison between slope of the calibration curve of the external standard and calibration curve of the standard addition), area precision (RSD%: <2.13 for ETB and <1.94 for 2A1B), recovery mean (101.7% for ETB and 99.95% for 2A1B) and quantification limit (mg L(-1): 10.17 for ETB and 19.70 for 2A1B), the method was successfully applied to ETB analysis in pharmaceutical formulation samples. It is possible to determine the presence of the 2A1B impurity at concentrations of less than 1% ETB content.

Hypothesis testing

- Drug A reduce blood pressure?
- Chemical A increase the reaction rate ?

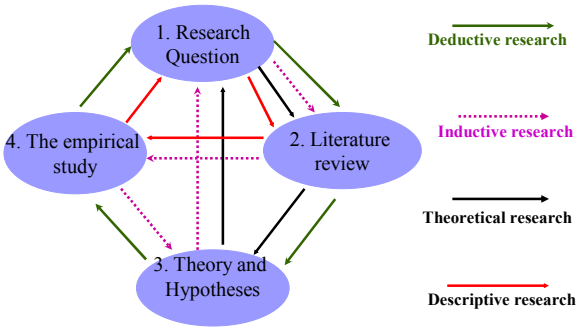


Inductive Reasoning

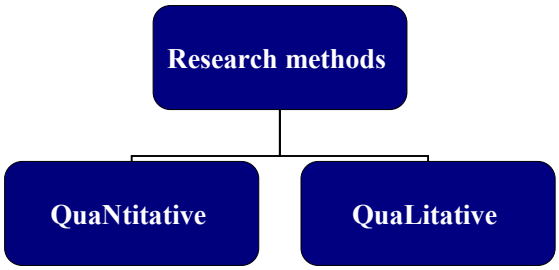


Deductive Reasoning

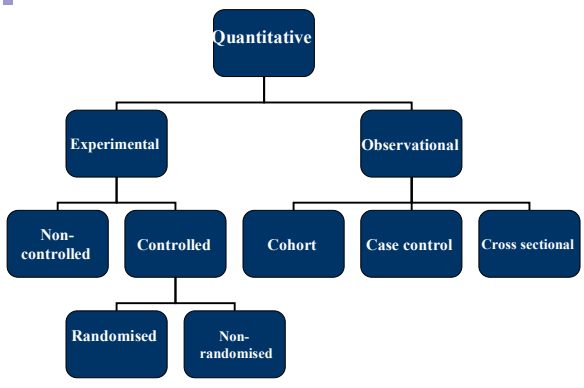
Process and Types of Research



33



19/04/2011 Sinaa Alaqeel 34



19/04/2011 Sinaa Alaqeel 35

Pharmacogn Mag. 2010 Oct;6(24):293-7.

Cytotoxic and growth inhibitory effects of the methanol extract Struchium sparganophora Ktze (Asteraceae) leaves.

Ayinde BA, Agbakwuru U.

Department of Pharmacognosy, Faculty of Pharmacy, University of Benin, Benin City, Nigeria.

Abstract

BACKGROUND: Global research into medicinal plants used in treating tumor-related ailments has become imperative due to the emergence of various forms of cancer diseases. Usually consumed as a vegetable, Struchium sparganophora is indicated in traditional herbal medicine as one of the plants used in treating tumor-related ailments.

MATERIALS AND METHODS: This claim was examined using bench-top assay methods involving the cytotoxicity of the methanol extract of the leaves to tadpoles of Raniceps ranninus at 10, 20, 40 and 80 µg/ml. Also, the growth inhibitory effects of the extract on guinea corn radicle at 0.5, 1.0, 2 and 4 mg/ml in addition to evaluation of the phytochemical constituents of the leaves was performed. After 24 h, the crude extract and the chloroform fraction produced the highest cytotoxicity of 96.67 ± 4.71%, each at a concentration of 80 µg/ml, while the aqueous fraction produced 100% cytotoxicity at a concentration of 20 µg/ml.

RESULTS: The crude extract had an LC50 of 26 µg/ml, the chloroform fraction had 6.25 while the aqueous fraction had 5 µg/ml. On the inhibition of the guinea corn radicle growth, after 96 h, the controls had an average length of 67.81 ± 2.6 mm, whereas the seeds treated with 4 mg/ml of the crude extract had an average length of 35.83 ±1.75 mm, indicating 47.81% reduction in length. At the same concentration, the chloroform and the aqueous fractions showed 32.51 and 43.81% inhibitions. The plant material was observed to contain alkaloids, tannins, saponins and flavonoids, with no traces of anthracene derivatives.

CONCLUSION: The results suggest the probable use of the plant in preparing recipes for tumor-related ailments.

19/04/2011 Sinaa Alaqeel 36

J Young Pharm. 2010 Jan;2(1):59-62.

Evaluation of Wound Healing Effect of Topical Phenytoin on Excisional Wound in Albino Rats.

Hasamnis A, Mohanty B, Muralikrishna, Patil S.

Department of Pharmacology, GSL Medical College, Rajahmundry, India.

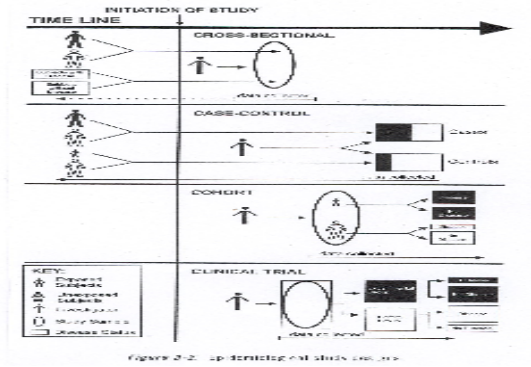
Abstract

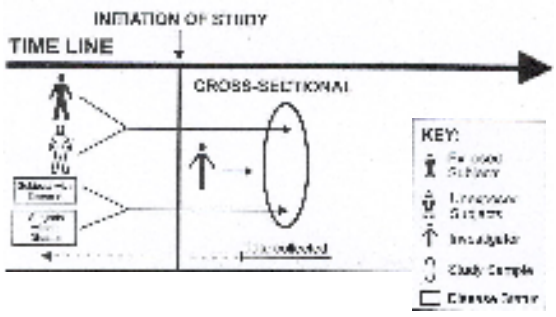
OBJECTIVES: Wound healing is a significant healthcare problem in today's medical practice. Despite extensive treatment modalities that are supposed to hasten the wound healing process, the outcomes of existing methods are far from optimal. One such agent that has been tried previously and found controversial in wound healing is phenytoin. In this study, the wound-healing efficacy of phenytoin was investigated in albino rats.

MATERIALS AND METHODS: 20 male Wistar albino rats were subjected to excisional wounds measuring 500 mm(2) on the back and then randomized to two groups (n = 10): Control group (A) and treatment group (B). The control group received no drug treatment till the end of the study. 1% Phenytoin cream was applied to the wounds of rats in the group B and continued till the 16(th) day of the study. The areas of wounds were measured on the Days 4, 8, 12, and 16 of the experiment. The percentages of the healing wounds were calculated by Walker formula after measurement of the wound area. The total number of days required for complete epithelization of wounds was noted in each group.

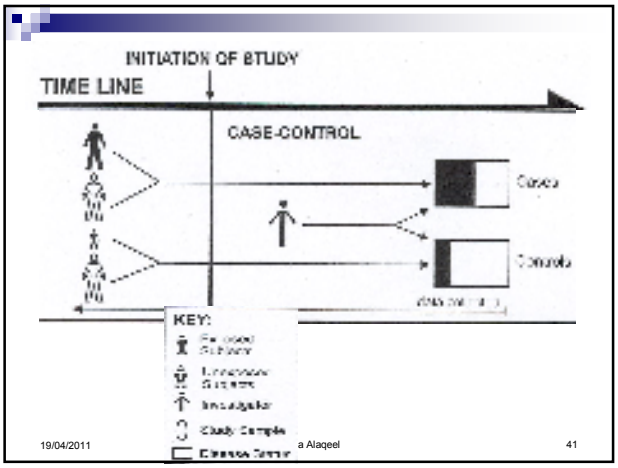
RESULTS: Statistically significant reduction (P < 0.05) in average wound area was seen in Group B (P value=0.0017, 0.0001, 0.0001, 0.0001), respectively, on Days 4, 8, 12, and 16 of the experiment in comparison to Group A. The average number of days required for complete epithelization of wound area was less in Group B as compared to Group A (P=0.0120). The difference was statically significant

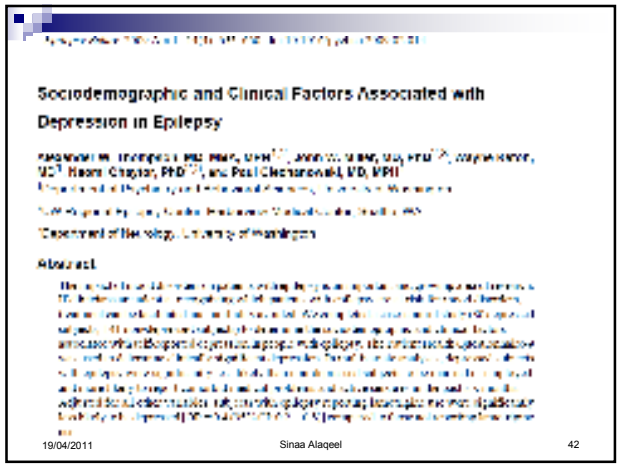
CONCLUSION: In the present study, topical phenytoin accelerated healing of excisional wound in albino rats.





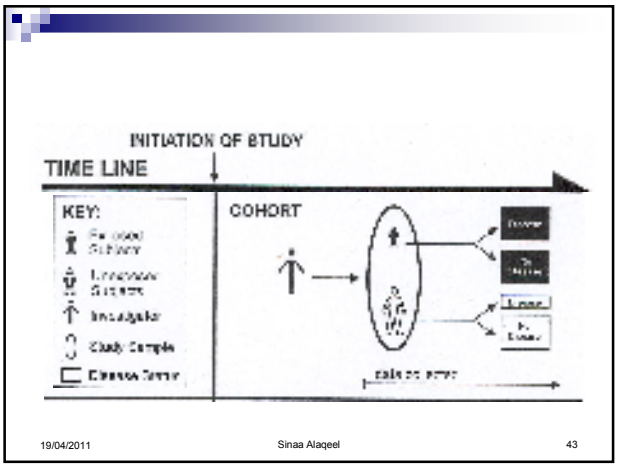
Effect of long-term valproate monotherapy on bone mineral density in adults with epilepsy

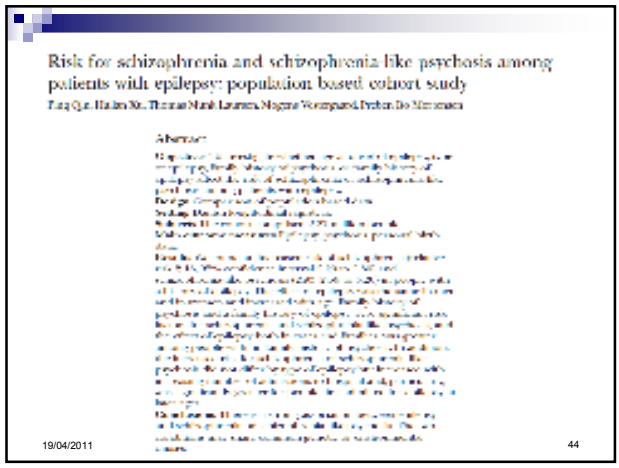




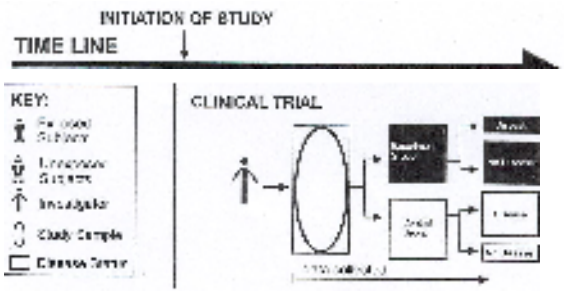
Sociodemographic and Clinical Factors Associated with Depression in Epilepsy

Abstract





Risk for schizophrenia and schizophrenia like psychosis among patients with epilepsy: population based cohort study



Side effects of phenobarbital and carbamazepine in childhood epilepsy: randomised controlled trial

ABSTRACT

Secondary drowning in a patient with epilepsy

Association of epilepsy and burns

A case control study

Working in groups identify main advantages and disadvantages of research designs discussed during this presentation…..

Building upon existing evidence to shape future research endeavours

Why do litreature review???

- Culling the literature
- Know your research databases
- Confirming the need for investigation
- Learning from the mistakes of others
- Common areas for improvement

Useful websites

PubMed Tutorial

http://www.nlm.nih.gov/bsd/disted/pubmed.html