Case Report: Teaching Pharmacology to High School Students from the Coxilha Rica Rural Community, State of Santa Catarina, Brazil

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INTRODUCTION

The Imagine Project aims to promote scientific inclusion in non-urbanized areas of developing countries.

Module 1 “DNA, diversity and heredity” and Module 2 “Energy” have already been presented at:

Guarani Tekoa’Uy’A Village (Major Gercino, SC)

Coxilha Rica (Lages, SC)

Calca

AIM

To report how the third thematic module entitled “Medicines: how do we know they are good for us?” was carried out at the itinerant school in Coxilha Rica.

METHODS

As a part of a subject offered by the Pharmacology Graduate Program from UFSC (PPG-FMC), graduate students and professors worked together during 4 months discussing topics about scientific popularization while developing activities intended to engage high school students in learning pharmacological topics. A group of 3 professors, 2 graduate and 4 undergraduate students spent 5 days at Coxilha Rica to apply the module created for the Imagine Project. Coxilha Rica is a rural neighborhood from the city of Lages and is located 80 Km away from downtown Lages. Lages is a city from Santa Catarina State, Brazil.

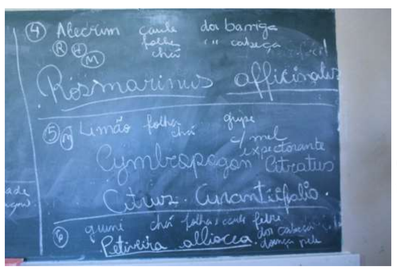
The group minus the photoghrapher

RESULTS

Activity 1: Ethnopharmacology and Ethnobotany

A) Search for medicinal plants in the surrounding area. Students were divided into teams to collect plants in different environments available in the community, such as pasture, riverbank, roadside, woods, etc.

B) Ethnobotanical survey by consulting the literature for initial species identification of the collected plants.



C) An ethnobotanical/ethnopharmacological table was constructed.

ABSTRACT

INTRODUCTION: The Imagine Project was first idealized by a group of professors from the Universidade Federal de Santa Catarina (UFSC) aiming to promote scientific inclusion in non-urbanized areas of developing countries. The project includes three different thematic modules: “DNA, diversity and heredity” and “Energy” have already been executed in different isolated regions, such as Coxilha Rica (Lages, SC, Brazil), the Guarani Tekoa’Uy’A Village (Major Gercino, SC, Brazil) and Calca in Peru; the third module “Medicines: how do we know they are good for us?” was hosted in Coxilha Rica (CR). The creation of this module was part of a subject offered by the Pharmacology Graduate Program from UFSC. Graduate students and professors worked together during 4 months discussing topics about scientific popularization and developing activities intended to engage high school students (HSS) in learning pharmacological topics. CR is a small rural community with limited access by car, telephone or internet. There are no close available medical care or pharmacy services, therefore, people from this community preserve the popular traditional use of plants and natural resources as alternative treatments for various diseases. The module was conceived as a way to stimulate a critical view and attitude towards natural or synthetic remedies and to provide knowledge about the source of bioactive products and their targets, toxic and therapeutic effects, as well as possible placebo effect. The aim is to report how the third thematic module was carried out at the itinerant school in CR. METHODS: A group of 3 professors, 2 graduate and 4 undergraduate students spent 5 days at CR to apply the module. RESULTS: 10 regular HSS attended the week of activities after previous agreement. Firstly, students were instructed to search in the neighboring areas for as many plants as they knew could be used as remedies, in order to construct an ethnobotanical table. From the material collected, they elected a single plant (*Petiveria alliacea*) to undergo different extraction procedures and compound detection by thin layer chromatography. The potential toxicity of the plant extracts was tested *in vivo* in *Artemia salina* preparation. The concept of pharmaceutical formulation was discussed while testing the solubility of commercial pills in different pH solutions. Anxiolytic placebo effect and distraction-induced analgesia were also demonstrated. The diversity of medicinal plants known by the HSS was large, some of the plants were known by more than one popular name or the same popular name was given to different species. Their knowledge about medicinal plants was not different from the ones reported in other regions. Nonetheless, most of them were neither aware of the possible toxic effects of the plants nor that powerful therapeutic outcomes could be achieved with placebo. CONCLUSION: The HSS from CR responded very well to all the topics approached by the module with interest and curiosity. The students were granted the chance to come to UFSC for a visit and some of them displayed the desire to attend university in the near future. Educational tools will be developed and will be digitally available as Open Educational Resources.

Activity 2: Bioactive Compound Isolation

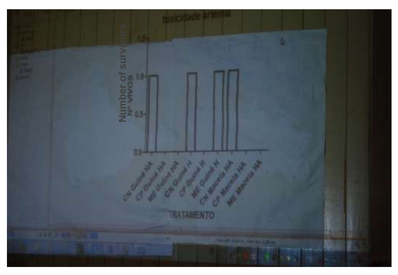
A) Extraction of plant compounds: The plant popularly known in the area as Guiné *(Petiveria alliacea)* was chosen by the students during activity 1. Maceration followed by subsequent extraction of its components by two different methods: aqueous extraction by infusion and hydroalcoholic extraction. The same extraction protocol was performed from a previously tested plant (Macela - *Achyrocline satureioides*).

B) Analysis of the hydroalcoholic and aqueous extracts by thin layer chromatography. The aim was to observe that plants have different substances that can be easily extracted with simple approaches such as tea preparations. Also, to show that these substances may be responsible for inducing biological effects in our body.

Activity 3: Pharmacokinetics

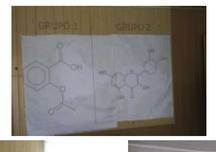
An stomach (acidic) and intestinal (basic) environment was created to observe how pH affects the disintegration of acetylsalicylic acid tablets with different coatings. Subsequently, media resources were used to demonstrate how the processes of disintegration, dissolution and absorption of drugs into the human body occur.

Activity 4: Drug Toxicity (dose vs. response)



Drug toxicity (dose vs. response) and the importance of animal testing: practical activity in which students used the previously obtained plant extracts to treat saltwater crustaceans (*Artemia salina*). It was possible to observe that the extract induced the mortality of crustaceans as shown in the graph. The bars represent the number of survivors (Y axis) obtained by different treatments (X axis). H (water); HA (hydroalcoholic), CN (negative control), CP (positive control).

Activity 5: Pharmacodynamics



A) Receptor selectivity: recognition of the design of a previously presented chemical molecule among several others that appear randomly on a projection. When a group recognizes its molecule, their leader picks up a rubber balloon filled with water and bursts into a bucket. At the end of the task, wins the group that fills up the bucket. The team must work to try to achieve faster recognition of standards.

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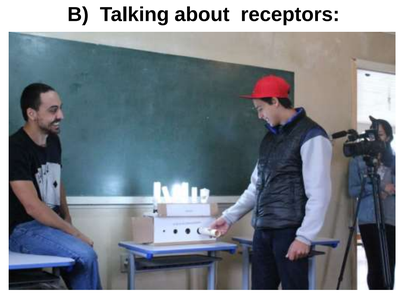
B) Talking about receptors:

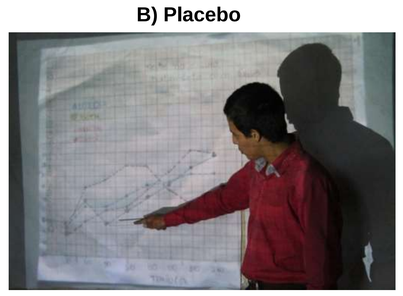


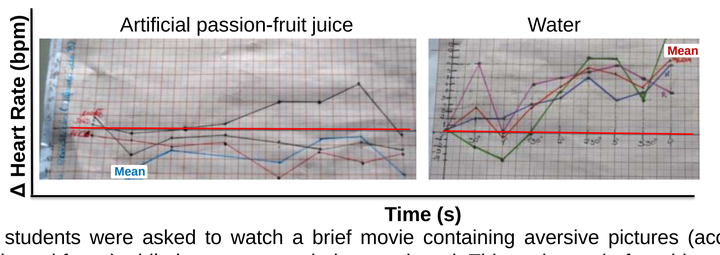
The students were expected to turn on or off lights in a box by attaching to it (in the corresponding openings of the box) different-shaped wooden pieces. Students may do the analogy of such activity with drugs binding to different targets in the body.

Activity 6: Distraction-Induced Analgesia and the Placebo Effect

A) Distraction: The students were asked to deep their dominant hands in a bucket containing ice-cold water (0±1 °C), while performing or not a parallel task of reading a scientific text out loud. The latency to withdrawal their hands from the bucket was registered and used as a parameter of nociception.

B) Placebo





The students were asked to watch a brief movie containing aversive pictures (accidents, death, sad faces) while heart rate was being monitored. Thirty minutes before this, students were aware about the putative relaxing effects of passion-fruit juice. Half of the students were randomly selected to take a glass of water, while a second group took an artificially flavored passion fruit juice thinking it was natural juice. As it can be observed in the graphs, heart rate (Y axis), as the difference from basal measurements, from the group that had juice was lower than that from the group that had water throughout time (x axis).

Activity 7: Take-Home Message

Sola dosis facit venenum

(Paracelsus)

In front of the School

The hard time of saying good-bye

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