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Design and Fabrication of a New Model to Evaluate Analgesic, Antipyretic and Anti-inflammatory Action of a Drugs

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Abstract: The purpose of present study is based on the fact that many drugs have more than one action and evaluation of one action of a drug requires one whole screening model whereas for the evaluation of other action of same drug will require one more different screening model. In this study a new model has been fabricated for the evaluation of three different actions of one drug i.e. evaluation of analgesic, anti-inflammatory and antipyretic activity. Aspirin has analgesic, antipyretic, anti-inflammatory, and antiplatelet activity. Evaluation of all the activities of aspirin, we will require four different methods and models but in our study the newly fabricated model alone will be able to evaluate three actions of a single drug.

Key words: Design, fabrication, new screening methods, standardization, aspirin, multiple actions, new model design

INTRODUCTION

History of animal experimentation

The history of animals in research dates back through millennia's, at least as far as to the experiments by Aristotle (384-322 BC) and Erasistratus (304-258 BC) on living animals. Erasistratus also appears to have performed vivisections on condemned criminals, whereas the famous Greek physician Galen of Pergamon (approx. 129- 200 or 217 AD), operating under the Roman law, had to restrain himself to only use animals such as pigs and monkeys in his dissections and vivisections.[1]

Regarding rats, a survey from 1998, available through the Mouse Genome database, listed 217 major rat strains where the National Bio Resource Project for the Rat in Japan currently (June 2012) lists 577 strains. Besides the above-mentioned mammals and flies, researchers use a plethora of other species as models, e.g. sponges, sea urchins, nematodes,

fish, bees, birds, cats, dogs and primates. [1]

Animal screening models play an important role in the pharmaceutical research. Experimental animals are scarifying their lives for the betterment of human society for centuries. Researchers who involved in animal studies should feel a responsibility towards experimental animals also. We know that animal studies require a large number of animals for the experiments. Many of them have to scarify their lives for the results of the experiments. In order to prevent the lives or to reduce the number of sacrifices, the pharmacological experiments must be designed in such a way that "minimum involvement of animals could produce maximum results or responses" or "minimum animal input and maximum experimental results".[2]

Many researchers gave their view on the above mentioned concept. 3R theory was one of them. My study is based on a concept that many drugs have multiple pharmacological actions on body and to evaluate all the pharmacological actions of a drug a researcher requires different pharmacological screening models. So, Different models will include different and a large number of animals. If we hyphenated more than one model and could convert into a single model then it will reduce the number of animals and resources. This study will help many researchers and pharmacologists to use a minimum number of animals for their studies. The following types of animal models can be hyphenated to study the multiple pharmacological actions of a single drug. [2]

Materials and Methods

Design of Model: The very first design of model was a sketch design. Gradually the final design was selected on the basis of various selection criteria like Single drug with multiple action hypotheses, on the basis of type of experimental animal, on the basis of area of study, on the basis of dimensions of model, and on the basis of material to be used for the fabrication of new model.

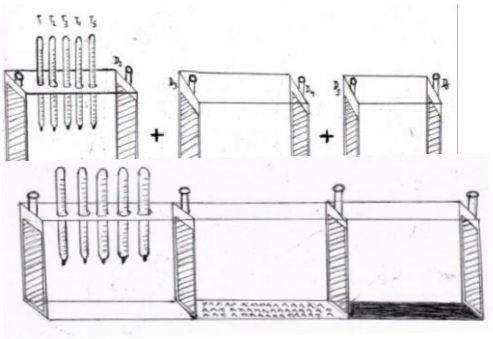
The model is based on the principle of "Refinement" through which we can obtain maximum output with minimum input.

The model is consisting of three chambers:

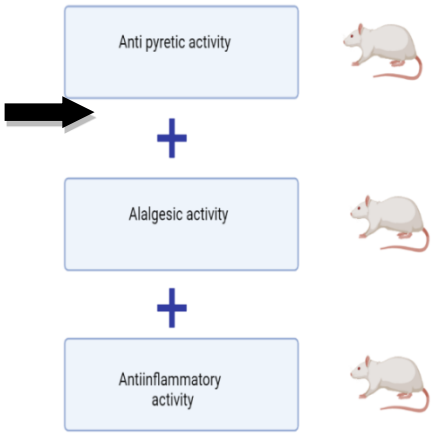
Chamber A (Anti-pyretic chamber) – It consist of wooden walls with thermometer observation space for observing the temperature of subject.

Chamber B (Analgesic chamber) – It consists of wooden walls with pointed pins at the bottom for observing analgesic effect of drug.

Chamber C (Anti-inflammatory chamber) - It consists of wooden walls with a steel slab at the bottom whose temperature is raised with the use of candle for observing anti-inflammatory effect of drug.

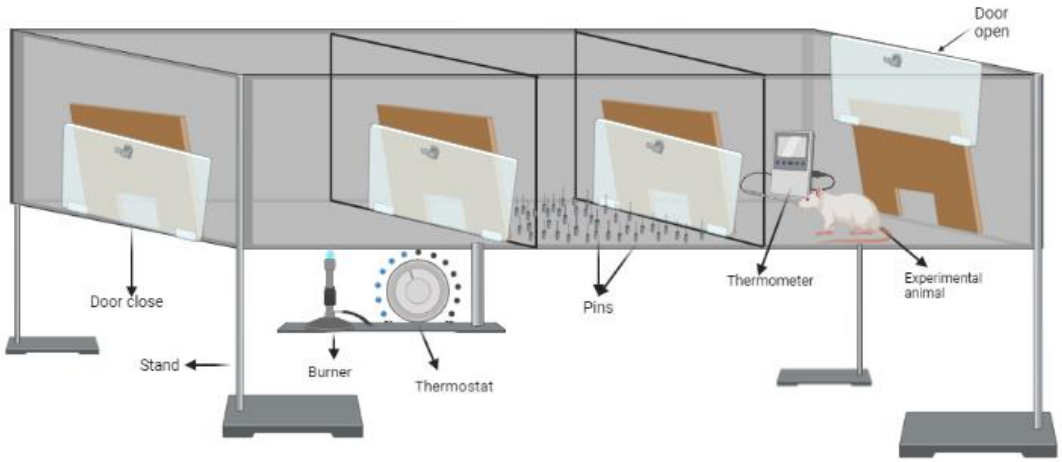


(Fig. 1: The sketch diagram model)



(Fig: 1 Design of a multi compartment model)

The final design will be as described in figure below.



(Fig 2: Final model design)

Material for fabrication of model

For making the multicompartment model the wood, plastic fiber and steel was used. The material to fix the wooden and other parts a good quality of adhesive was used. Nails, hammer, cutter, transparent plastic fiber, wooden ply and steel were purchased from the local market of Indore, Madhya Pradesh.

Wood: The wood as a fabrication material allows an easy transportation. Wooden look of new model also attract the viewers. The cutting of wood is easy as compared to other material. Wooden material is not so expensive. All these factors allow selecting wooden material as a material of fabrication. But as I explained the final design of my material that also includes the heat in one compartment of my model so, only wood cannot be included in the entire compartment. The base of model is made up of heat resistant material like iron.

Iron as a fabrication material may be a good choice due to its mechanical strength. However, it was not selected as a material of fabrication as a whole due to its weight and rusting problem. Iron is a good conductor of heat. Some part of my model requires the heat conduction for the determination of analgesic activity. So, In the analgesic compartment of new model some part of iron has used. Therefore the final fabricated new model will composed of wood, some iron, and plastic fiber as a material of fabrication.

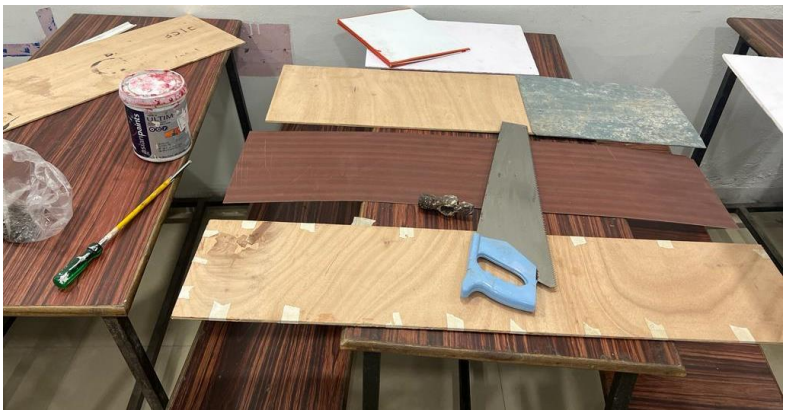


Fig 3: The materials of fabrication

Fabrication of multicompartment model

According to my reference design the 8mm of ply was cut into the required pieces. An adhesive was the applied to the cut pieces of ply. A brown colour mica ply sheet was then pasted to the adhesive. With the help of nail and hammer the pieces of ply were added to each other as per my reference design.

After combining of two sheets, the making of compartments was started. To provide the inflammatory external stimulus to the rat, the small nails (0.75 inches) were installed in rows and columns (As shown in figures) at equal distance. Before pinning up the nails as an external stimulus of inflammation the nails were painted to prevent rusting. The pinned up nails had sufficient strength to bear the weight and movement of an experimental animal.

After making the bed of nails in the inflammatory compartment of model, the top of the model was covered in such a way that the door could be installed and operated later. So, a gap of 15mm was provided to the top cover just before starting each compartment (as shown in figure). This step of fabrication was very important; therefore extra care was taken into consideration to prevent the breakage of model. After combining the three dimensions of model, the front portion of model was covered with a transparent plastic fibre. The transparent sheet helps to observe movement of animal, activity and end point of the experiment. It also enhances the appearance of multiple compartment model (as shown in figure) LED light was also installed to provide sufficient lux for experiment because some times for better observation we need to record videos also.

Fig 4: Fabrication of Multicompartment model

RESULT AND DISCUSSION

At the early stage of fabrication of model the required material was arranged from the local market of Indore MP as shown in figure. According to the dimensions of model the 8mm ply was cut by me with the help of a local carpenter and his tools. A general design was made by me for the reference in laboratory. According to my reference design the 8mm of ply was further cut into the required pieces. An adhesive was the applied to the cut pieces of ply. Here are some pictures of finally fabricated multiple compartment model.

The top view of model: The finally fabricated model looks like a rectangle of wood from the top side. The doors are visible with the running channel for pushing it downwards or pulling it upward direction.

Fig 5: (The top view of model)

The side view of model: From one side a transparent plastic fiber sheet has attached, so that the live experimental activity can be observed. This is very important side of the model. From this side of model all three compartments (i.e. antipyretic, analgesic and anti-inflammatory) are clearly visible.

Fig 6: (The Side view of model)

The front view: From this side of the model either antipyretic compartment is seen or anti-inflammatory compartment is seen if the respective doors are closed. If the doors are open then all three compartments can be seen in a straight line.

Fig 7: (The front view of the model)

The back side view of the model: This side is just opposite to the front side portion of the model (Opposite to transparent side). This whole side is covered with the wooden sheet. No compartment is seen from this side. From this side the model looks a single unit.

Fig 8: (The back view of model)

Fig 9: (Other views of the multicompartment model)

Working of Multi compartment model

Experimental animal enters in chamber A (Anti-pyretic chamber) from Door -1 where thermometers were set manually for observing the body temperature of subject. Stop watch was used for the observation. After 10 minutes of observation, experimental animal was allowed to enter into the chamber B (Analgesic chamber) which is having pointed pins at bottom. The activity of experimental animal was observed for the analgesic effect of drug.

Then experimental animal was allowed to enter into the chamber C (Anti-inflammatory chamber) which is having glass-slab at the bottom whose temperature was previously raised by using candle heat. In chamber C, results for anti-inflammatory activity of drug were observed.

CONCLUSION

This pharmacological work is dedicated to the lives of experimental animals. Each proposed working model will give results of more than one or two models. Multi compartment model can be standardise to evaluate the analgesic, anti-inflammatory and antipyretic activity of a single drug. Our study support to the 3R theory. In minimum input of animals and other resources we can get the maximum output.

In the present study we gave an approach for the evaluation of multiple actions of a drug using a single screening model. Many models now can be fabricated for various activities by applying the same approach. The material used in the making of new model was selected on the basis of its stimulatory factors involved in experiment, compatibility, availability, and cost of material.

The model can be fabricated very easily in the laboratory by knowing the basics of carpentry. The material can be easily cut into the pieces and re-joined according to the need and design of the new model. In all three compartment of the model, selection of an external stimulus plays very an important role. It is required to produce pain stimulus, rise in body temperature and paw redness and irritation were important factors.

The sequence of experiment and pathway provided to an experimental animal was very specific and well planned. The doors of new model were designed to keep experimental animal into the correct compartment at correct time. It was taken into consideration that animal should move forward during the experiment and opening and closing of doors play an important role for achieving the same.

In future, standardization will be done by obtaining the result from new model and from the available old tradition models and comparing the results. Some modification can be done in the new model. The doors can be motorized; cameras can also be installed in the new model, and observation can be digitalized. The approach involved in the present study can be utilized for making of many new different models for the drugs having the different multiple pharmacological actions.

REFERENCES

1. Gurinder S., Balbir S., and Promila M., (2018), Antipyretic activity investigations on various extracts and fractions of Jwarnashak Panch Kashya, Journal of Pharmacognosy and Phytochemistry 2018; 7(3): 3017-3020
2. Awatif M., Saaedi A., and Zainab M., (2018), Evaluation of the antipyretic activity of the aqueous extract of Zinger (Zingiber officinale) rhizome in female rats, IOSR Journal Of Pharmacy, 8 (1) : 01-03.
3. Jarrod B., Michelle T., Michael B., (2014), An Analysis of the Use of Animal Models in Predicting Human Toxicology and Drug Safety, AlternLab Anim, 42 (3): 181-99.
4. Tinneke D., Thomas S., Maarten V., (2014), Animal models in translational medicine: Validation and prediction, European Society for Translational Medicine, 2 (1): 5–11

5. Ray G., and Andre M., (2010), Systematic Reviews of Animal Models: Methodology versus Epistemology, International Journal of Medical Sciences, 10 (3): 206-221.
6. Crews E L, Fuge K W, Oscai L B, Holloszy J O and Shank R E.Weight, food intake and body composition: effects of exerciseand of protein deficiency. Amer J Physiol, 216:359-363, 1969.
7. Hirsch J and Han P W. Cellularity of rat adipose tissue: effectsof growth, starvation and obesity. Journal of Lipid Research,10:77-82, 1969.
8. Johnson P R, Zucker L M, Cruce J A F and Hirsch J. Cellularity ofadipose depots in the genetically obese zucker rat. Journal ofLipid Research, 12:706-714, 1971.
9. Kregel K C. Design of animal exercise protocol. 1st ed,American Physiological Society, Bethesda MD, 2006.
10. Oscai L B, Spirakis C N, Wolff C A, Beck R J. Effects of exerciseand of food restriction on adipose tissue cellularity. Journal oflipid research 13:588-592, 1972.
11. Scalfani A, Springer D. Dietary obesity in adult rats:similarities to hypothalamic and human obesity syndromes.Physiol Behav, 17:461–471, 1976.
12. Vogel H G. Drug Discovery and Evaluation: Pharmacologicalassays. 2nd ed, Springer-Verlag, Berlin Heidelberg New York, 2002.