Students Name:

Professors Name:

Course:

Date:

Interaction of capsaicinoids with cell membrane

**1. Write a few sentences summarizing the article’s main message. Why was this an important study? Relate it to work done by previous authors.**

The article’s main message was that capsaicinoids from a Malagueta and a Bhut Jolokia pepper did not exhibit significant interactions with the cell membrane. This is to be expected due to the minuscule concentrations of these pepper components. If it had, capsaicin would occupy the negatively charged regions on the cell membrane while DPPC and DPPG reside in regions of higher hydration resulting in no interaction. As there are no other studies on the interaction of capsaicinoids with cell membranes, this study serves as a basis for future studies. Future studies can be based on the interactions observed here, namely hydration of the phospholipids and alkylation of the acyl chains.

The results of this study showed that the pungency of capsaicinoids was not related to the interaction with cell membrane models, meaning that capsaicinoids were not able to alter the hydrophobicity of membranes and thus could not be used in order to test the change in pungency. The work presented here is an important step in understanding how pungency depends on various factors, it also showed some new ideas and evidences regarding this area of research. It also brought valuable information about how capsaicinoids act on cells membranes when they come in contact with them, it also supported an idea presented by previous authors on the same field.

**2. Write a few sentences summarizing the article’s introduction. What were the goals? What were the hypotheses?**

The article’s introduction presented a brief history of capsaicinoids and their interaction with TRPV1, it then went on to discuss the interaction of capsaicinoids with cellular membranes. The author also mentioned that most studies deal with capsaicinoids in order to find ways to make more potent pepper extracts, how they act on cell membranes, the dangers they pose and how they can be used as drugs. Keeping in mind that this is the first study that focuses solely on the interaction of capsaicinoid with lipid bilayers.

The main goals and hypotheses that were set out by the authors were to investigate if capsaicinoids from a Malagueta pepper and a Bhut Jolokia pepper interact with cell membranes and if their interaction was dependent on hydration states. The capsaicinoids also interacted with phospholipids, one of the most abundant lipid classes found in cells. The cell membranes used in this study are made with phospholipids, one of the most abundant lipid classes found in cells. The results of this study showed that the interaction between capsaicinoids and cell membranes was not dependent on hydration states as well as capsaicinoids were not able to alter the hydrophobicity of cell membranes, thus resulting in no pungent effect.

**3. Describe briefly the methods used in the paper. Where was the study done? How exactly was it done? How many times was it done? Be as brief as possible.**

The methods used in the study were as follows: (1) Capsaicinoids from a Malagueta pepper and a Bhut Jolokia pepper were extracted using CHCl3, MeOH and MeOH-CHCl3 mixtures; (2) Phospholipid monolayers made with DPPC and DPPG were used to investigate whether capsaicinoids interacted with them; (3) Capsaicinoids were also extracted from capsicum oleoresins and incorporated into liposomes made of dipalmitoyl phosphatidylglycerol (DPPG); These steps have been repeated three times. The research was done in the anatomy laboratory of the Faculty of Medicine at the University of São Carlos.

**4. Write a sentence or two explaining each table or figure. How does each relate to the paper’s goals? What conclusion can you draw from it?**

Figure 1: The figure shows the structures of capsaicin, dihydrocapsaicin, nordihydrocapsaicin and homocapsaicin.

Figure 2: This figure shows FTIR spectra of capsaicinoids extracted from Bhut Jolokia peppers (Caps-B) and Malagueta (Caps-M). This relates to the papers goal as it shows the chemical structure of capsaicinoids and the results of the extraction.

Fig 3: This figure shows a molecular-level-affiliation amid either DPPC or DPPG and Caps, with a minimal deviation from the regulation of additivity. This relates to the papers goals, as it shows that capsaicinoids interact with both phospholipid classes, encapsulation of capsaicinoids into liposomes also shows this. The molecular-level-affiliation is a chemical formula of the degree in which two chemical compounds are chemically related. It refers to chemical properties and can be expressed as a numerical value. In this case the figures show that capsaicinoids do not only interact with DPPC and DPPG but they can also interact with both phospholipid classes, in other words they have no only interaction with one class, as previously shown by previous works.

Figure 4: This figure shows the structures of phospholipids used. It also shows a molecular model of the monolayer and there bonding and charge distribution. This relates to the papers goals, i.e. how capsaicinoids interact with phospholipids in terms of their bonding and charge distribution.

Fig 5: This figure shows the interaction between Caps-M/DPPC and Caps-B/DPPG Langmuir monolayer as detected by infrared spectroscopy. This relates to the papers goal as it shows that capsaicinoids interact with phospholipids not only in terms of the bonding but also in terms of their charge distribution.

Table 1: This table shows the frequency of bands for the infrared spectra taken from the surface of pure DPPC, pure DPPG and Caps-M and Caps-B mixed together. This information was used to determine the interaction between capsaicinoids and phospholipids. This relates to the papers goal as it shows the interaction between capsaicinoids and phospholipids and how they are different on the level of interaction of capsaicinoids with DPPG and DPPC.

**5. Summarize the paper’s results. Do they match the goals? Were the results conclusive or just suggestive?**

The results of the study showed that capsaicinoids from a Malagueta pepper and a Bhut Jolokia pepper did not interact with cell membranes, they did not interact with phospholipids at all but they interacted with phospholipid monolayers in head group regions. This shows that capsaicinoids from these two peppers do not belong to the same molecule class, thus no synergistic effect was shown between dihydrocapsaicin and other capsaicinoids.

The results are conclusive as the goal stated was to investigate if capsaicinoids interact with cell membranes and if this interaction is dependent on hydration states. The conclusion that can be drawn is that capsaicinoids from a Malagueta pepper and a Bhut Jolokia pepper do not belong to the same molecule class, no synergistic effect of capsaicinoids has also been determined.

**6. What is interesting about the paper? What did you learn? How does this paper relate to topics discussed in Biology 1107 – Principles of Biology I class? Be explicit about this.**

What’s interesting about the paper is the conclusions drawn from it, i.e. capsaicinoids do not belong to the same molecule class and no synergistic effects have been observed in cell membranes. This is interesting because capsaicinoids are a chemical compound that can be used in an external way (i.e.:pain relief) as well as internally (i.e.:as a treatment for diseases like cancer). This paper relates to the topics discussed in principles of biology class as they are related to cell theory, membrane theory and chemical compounds. Therefore, it is important to be able to identify and understand capsaicinoids because they can be used in a variety of ways, which may not have been thought of before. On that note, i have learned that capsaicinoids have many uses, some of which may not even have been considered before this study. For example capsaicinoids could be used for their pain relieving properties which is something i had never even thought about before taking this class.

**7. What questions remain in your mind after reading this paper? List at least 2.**

The first question that came to mind was how the capsaicinoids were extracted from peppers. It is interesting how the results of this process were used to come to conclusions about capsaicinoids and phospholipids. The next question that came to my mind was whether these results would apply for extraction of other capsaicinoids or if they are special only to these two peppers. If this method is used on other peppers, would the same results be obtained?

Work Cited

Geraldo, Vananélia PN, et al. "Interaction of capsaicinoids with cell membrane models does not correlate with pungency of peppers." *Chemical Physics Letters* 673 (2017): 78-83.