

## Iontophoretic permselectivity properties of porcine esophageal epithelium

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### Purpose

The aim of the study was to characterize the permselective properties of porcine esophageal epithelium during iontophoresis in order to validate it as a model for porcine buccal epithelium in in-vitro experiments.

### Methods

The isoelectric point (IP) of porcine esophageal epithelium was determined by the measurement of sodium transport number  $t_{Na^+}$  and of the electroosmotic flow of a hydrophilic non ionized molecule (acetaminophen, AAP).

$t_{Na^+}$  experiments were set up using horizontal diffusing cells. The two compartments of the cell were filled with two sodium hydrochloride solutions with different concentration in symmetrical pH conditions. The potential difference developed, due the charge separation, was measured using Ag/AgCl electrodes. The membrane potential, measured at different pH, was used to calculate the sodium transport number.

AAP permeation experiments were performed in Franz type vertical diffusion cells. AAP electroosmotic flux was measured under cathodal and anodal iontophoresis conditions at different pH values.

Finally, the permeation of model drug lidocaine hydrochloride was studied from water solution at pH 7 under anodal iontophoresis.

### Results

The results obtained show that the  $t_{Na^+}$  increase as the pH of the solution is increased. The IP of the epithelium calculated from  $t_{Na^+}$  is in the range 3 and 3,5. To further confirm IP value, AAP electroosmotic flux was measured at different pH under cathodal and anodal iontophoresis. From the data obtained, IP resulted to be about 4. These results suggest that, at physiological pH, the esophageal epithelium is negatively charged and selectively permeable to cations. The comparison between the lidocaine hydrochloride flux at pH 7 obtained in passive and under anodal iontophoresis showed that the application of current improves the flux, with a calculated enhancement factor of 4,27, confirming that IP value is lower than physiological pH, and that the epithelium is negatively charged.

### Conclusions

Esophageal porcine epithelium behaves as a permselective membrane and its IP is between 3 and 4,5. The measurement of the flux of lidocaine hydrochloride, at pH7, confirms that the mucosa has a net negative charge in physiological condition and is selectively permeable to cations.

In conclusion, the porcine esophageal mucosa could be considered a reasonable alternative model to the buccal porcine mucosa for the study of drug permeation during iontophoresis.