Butyric acid and derivatives: In vitro anti-inflammatory effects tested in porcine alveolar macrophages

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Background

- Butyric acid and its derivatives have beneficial effects when included in animal feed and they are currently under investigation for its effects on host cells in vitro.
- Butyrate may be an effective feed additive because it modulates immune response of host cells in vitro (Weber and Kerr, 2006; Chen and Vitetta, 2018).

Porcine alveolar macrophages (PAMs) can be isolated from weaning piglets by methods described by Liu et al., (2013) and cultured with a lipopolysaccharide challenge to induce inflammatory response.

- Butyric acid (Fig. 1) and its derivatives, sodium butyrate (Fig. 2), monobutyrin (Fig. 3), and tributyrin (Fig. 4) are different compounds which may deliver butyrate in vivo.

Objective

To examine the anti-inflammatory effects of butyric acid, sodium butyrate, monobutyrin and tributyrin using porcine alveolar macrophages (PAMs).

Materials and methods

- Bronchial lavage with ~100 mL ice-cold PBS from 6 healthy weaned piglets was used to isolate porcine alveolar macrophages (PAMs).
- PAMs were seeded at 10^5 cells/mL and cultivated overnight.
- 2x5 factorial experimental design, n=12:
  - Factor 1: 5 levels of butyric acid or derivatives
    - Doses: Butyric acid, tributylin—0, 0.5, 1, 2, 4 mM;
    - Monobutyrin, sodium butyrate—0, 1, 2, 4, 8 mM.
  - Factor 2: with or without 1 µg/mL lipopolysaccharide (LPS) challenge

Results

- Bronchial lavage with ~100 mL ice-cold PBS from 6 healthy weaned piglets was used to isolate porcine alveolar macrophages (PAMs).
- PAMs were seeded at 10^5 cells/mL and cultivated overnight.

- Butyric acid, tributylin, and monobutyrin reduce TNF-α secretion in non-challenged cells.

Conclusions

- Butyric acid, tributylin, and monobutyrin reduce TNF-α secretion in non-challenged cells.
- Sodium butyrate may induce TNF-α secretion at higher doses.
- Butyric acid, tributylin, monobutyrin, and sodium butyrate dose-dependently reduce the secretion of TNF-α by Porcine Alveolar Macrophages challenged with lipopolysaccharide (1 µg/mL).

References