

Fermentation of colloidal oatmeal by cutaneous bacteria results in enhanced production of lactic acid and short chain fatty acids

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Disclosure: This work was supported by Johnson & Johnson Consumer Inc. and Janssen R&D Companies of Johnson & Johnson.

Introduction, Hypothesis, Methods

Introduction

- Atopic dermatitis is associated with microbial dysbiosis and colonization of *Staphylococcus aureus* (SA) ¹.
- Oat (*Avena sativa*) in colloidal form is a centuries-old topical treatment for skin conditions such as atopic dermatitis.
- Prebiotic is a concept established in the area of digestive health. It is defined as: A selectively fermented ingredient that allows specific changes both in composition and/or activity in the gut microflora that confer benefits ². It has been well accepted that colloidal oatmeal is a prebiotic for gut ³.
- Our recent clinical study with an atopic dermatitis cream (AD Cream) containing 1% colloidal oatmeal showed a significant increase in skin hydration, decrease in skin pH, and increase in microbial diversity beginning at day one, and strongly suggests that colloidal oatmeal directly acts on skin microbiota ⁴.

Hypothesis

- We hypothesized that colloidal oatmeal directly acts on the skin microbiota as a prebiotic to provide therapeutic benefits.

Methods

- Bacterial growth was detected by the BacT/Alert System, pH of the media was measured by a standard pH meter.
- For lactic acid level, indicated bacteria was cultured to stationary phase, and bacteria were removed by centrifugation. Culture media was submitted for LC/MS/MS for lactic acid detection.
- For the lactate content, D-Squame tape strips were collected from the legs of human subjects followed by off-line extraction and colorimetric quantitation of lactate levels normalized to total protein in the skin sample.

1. Grice, E.A., et al. *Science* 2009;324:1190-1192.

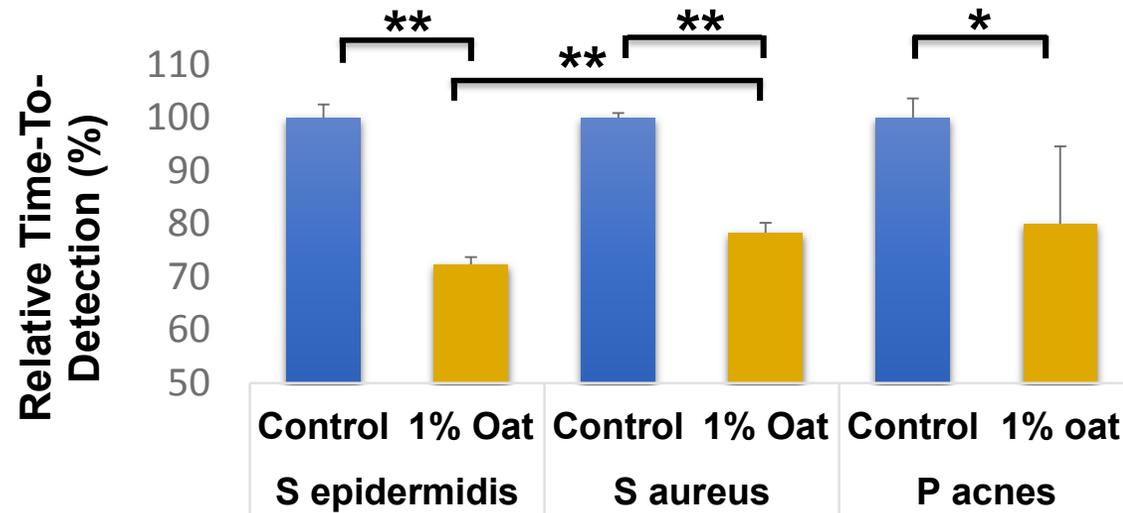
2. Gibson, G.R.; Roberfroid, M.B. 1995. *J. Nutr.* 125,1401-1412.

3. Varma, P., et al. *J. Clin. Prev. Cardiol.* 2016;5(1):9-17

4. Capone, K., et al. Poster presentation at the 76th Annual Society for Investigative Dermatology (**SID**) Meeting: April 26-29, 2017; Portland, OR

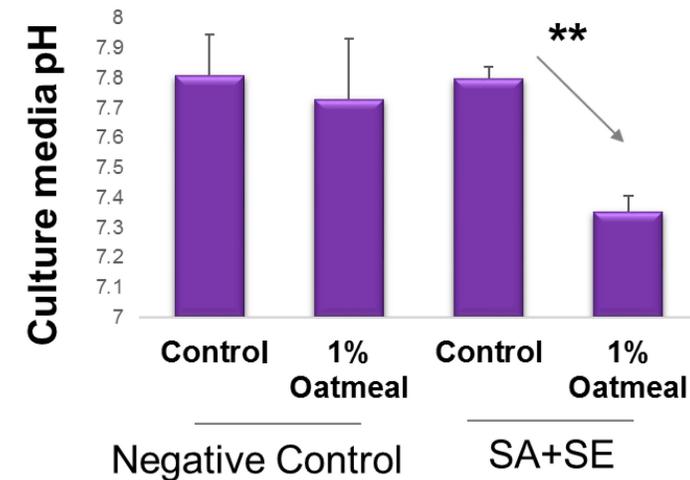
Results

Colloidal oatmeal promoted the growth of skin commensal bacteria



n=5. * p<0.05; ** p<0.01

Metabolism of the colloidal oatmeal by *S. epidermidis* and *S. aureus* resulted in reduced pH of the culture media

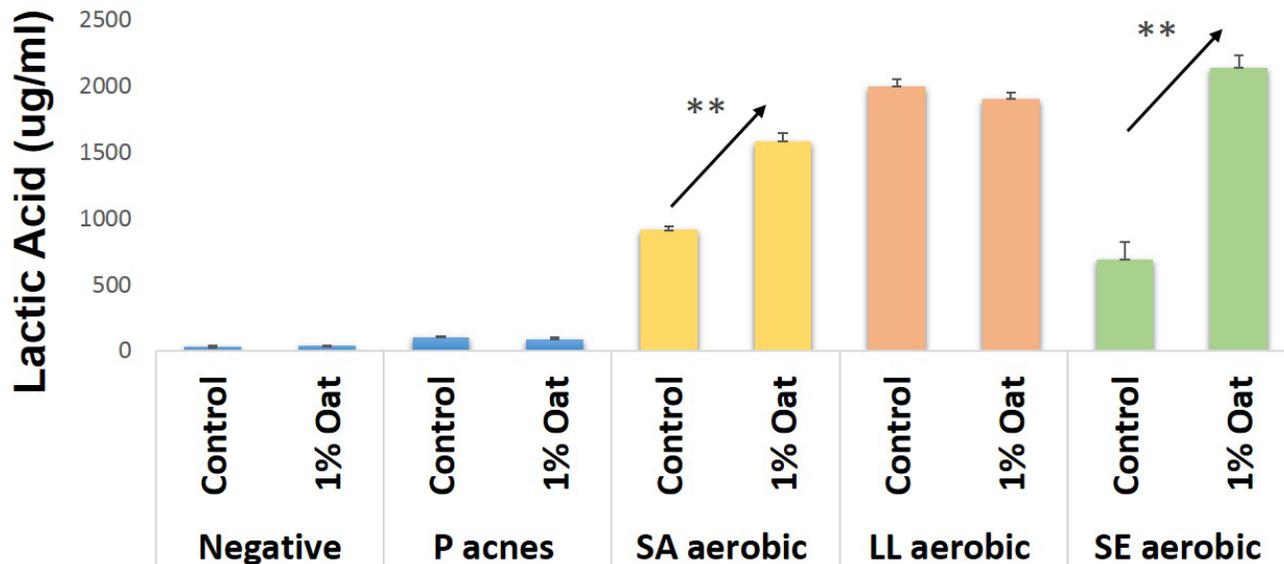


n=6. ** p<0.01

- Our recent clinical study shows that the AD Cream containing 1% colloidal oatmeal significantly decreased skin pH starting from day one ⁴.
- Colloidal oatmeal is metabolized by members of skin commensal bacteria such as *Staphylococcus epidermidis*, *Staphylococcus aureus* and *Propionibacterium acnes*, and promotes the growth of those bacteria. Importantly, colloidal oatmeal increased the growth rate of *Staphylococcus epidermidis* significantly more than that of *Staphylococcus aureus*, suggesting a differential response of these organisms to oatmeal.
- Our recent clinical study shows that the AD Cream containing 1% colloidal oatmeal significantly decreased skin pH starting from day one ⁴.
- Consistent with these clinical data, metabolism of 1% colloidal oatmeal by *Staphylococcus epidermidis* and *Staphylococcus aureus* decreased the pH of the culture media, most likely due to increased production of organic acids.

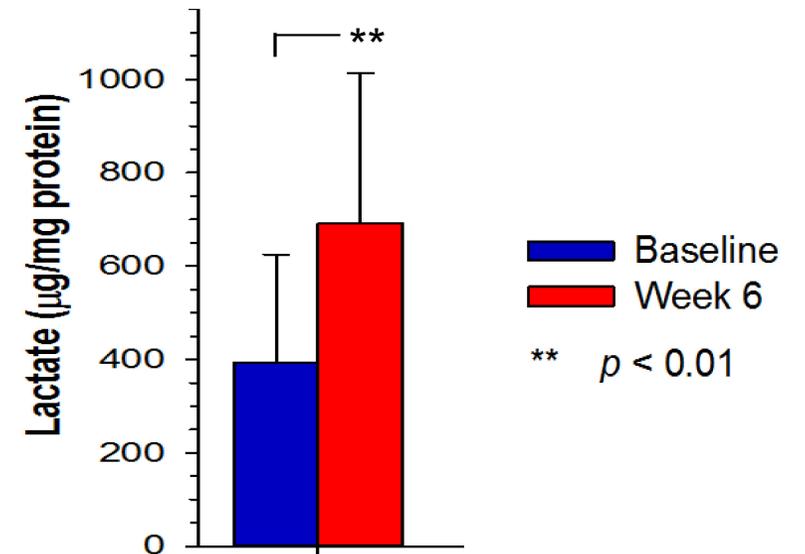
Results (cont.)

Metabolism of colloidal oatmeal by *S. epidermidis* and *S. aureus* resulted in increased production of lactic acid



n=3 * p<0.05; ** p<0.01

Treatment with a Moisturizing Lotion with 1% colloidal oatmeal significantly increased lactate content in subjects with dry skin



Legend:
■ Baseline
■ Week 6
 ** p < 0.01

- Metabolism of oatmeal resulted in increased production of lactic acid by *Staphylococcus epidermidis* and *Staphylococcus aureus*. Lactic acid is a known natural moisturizing factor with numerous skin benefits. Interestingly, as the precise origin of the lactic acid on skin is not well defined, our data suggested that at least one source is from members of our skin microbiome.
- Our recent clinical study revealed that 6 weeks use of a Moisturizing Lotion containing 1% colloidal oatmeal significantly increased the level of lactate in vivo.

Conclusions

- To our knowledge, this is the first study to demonstrate that colloidal oatmeal promotes the growth of members of the skin microbiome. Moreover, we demonstrated that colloidal oatmeal increased the growth rate of *S. epidermidis* significantly more than that of *S. aureus*, thus demonstrating colloidal oatmeal is a prebiotic for the skin microbiome.
- Importantly, in addition to the previously known benefits of colloidal oatmeal, we have uncovered that oatmeal is metabolized by members of the skin microbiome to generate lactic acid, a known natural moisturizing factor with numerous skin benefits.
- This study uncovers a new mechanism of action for colloidal oatmeal, and helps to further our knowledge on the benefits of colloidal oatmeal for skin health.