

Twin Shime Study about AG on Gut Microbiota Homeostasis



- ❖ To compare effect of long-term repeated administration of Arabic Gum and FructoOligo Saccharides on the composition and metabolism of the gut microbiota
- ❖ In vitro study using the Multi-compartment Simulator of the Human Intestinal Microbial Ecosystem (SHIME)
- ❖ To assess that AG and FOS have different digestibility and induced different colon region-specific effects
- ❖ Inoculation with faecal material from healthy donors



Twin-Shime study

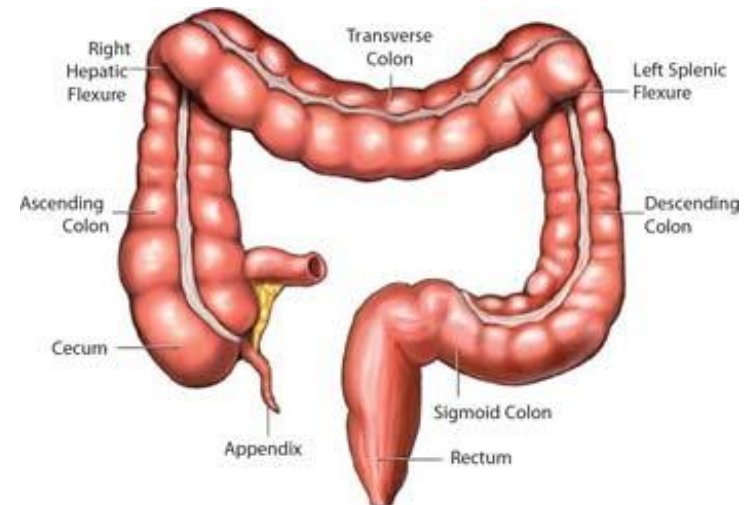
The SHIME device and the Colon anatomy



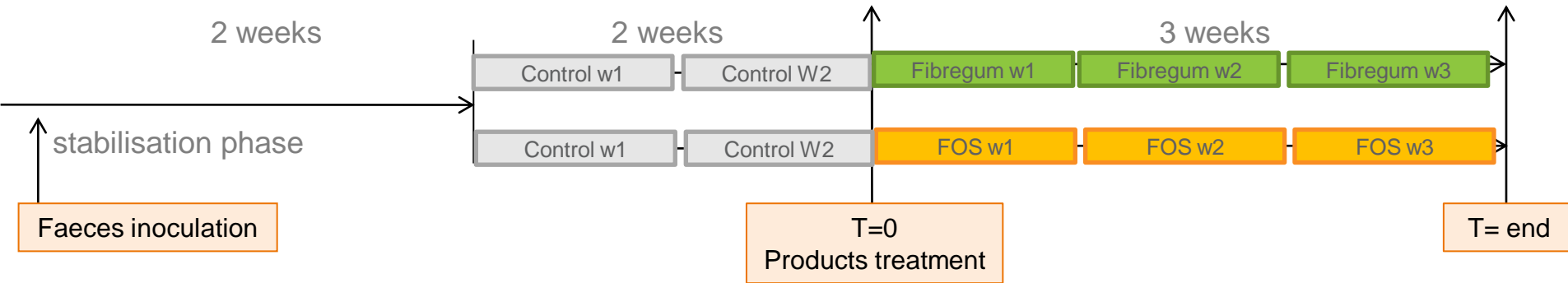
Stomach (1 & 2)
Small Intestine (1 & 2)

Ascending colon (AC),
Transverse (TC) and
Descending (DC) of
product 1 : FIBREGUM

Ascending Colon (AC),
Transverse (TC) and
Descending (DC) of
product 2 : FOS



Anatomy of Large Intestine

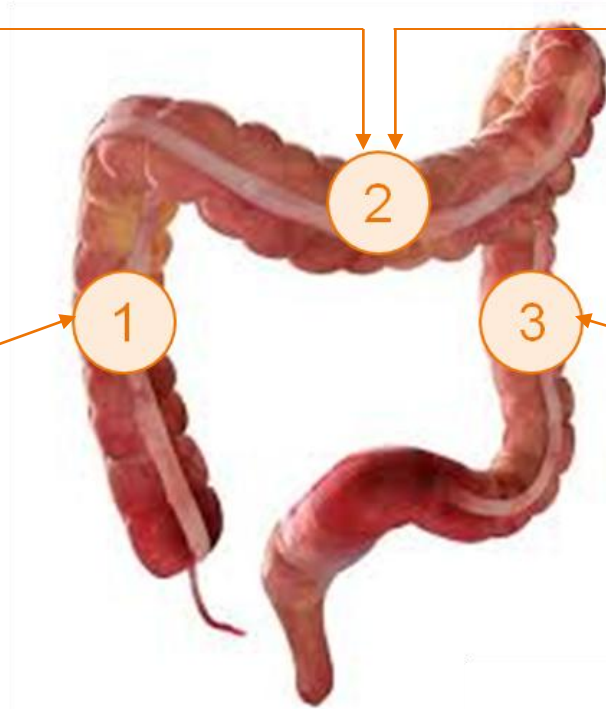


Samples and analysis carried out :

- ✦ pH, over a 48 h period
- ✦ 3 samples / week to measure:
 - H₂, CH₄, CO₂ in each compartments
 - Short Chain Fatty Acids
- ✦ Fibres digestion analysis (Size Exclusion Chromatography)
- ✦ Microflora analysis : 1 sample / week :
 - Microflora

Different fermentation pattern:

FOS are **rapidly fermented** within 4 to 6 h, mainly in the proximal colon (1-2)



AG is more **gradually fermented** within 24 to 48 h, mainly in the distal colon (2-3)

1 : Ascending
2 : Transverse
3 : Descending

Fermentation is assessed by:

❖ Size Exclusion Chromatography (SEC):

- ❖ Part of the GA is fermented in the transverse colon and a residual part is still available for fermentation in the final part of the colon
- ❖ All the FOS are fermented in the ascending colon

❖ pH profiles:

The Δ pH at 48 h was higher for FOS than AG

❖ Gas analysis:

Total gas production resulted to be higher for AG, nevertheless, FOS produced a boost of gas while AG, due to his more gradual fermentation lead to more progressive gas production.

- ❖ Physiological effects on tolerability:
Gradual fermentation of AG is much more comfortable than the « boosted » fermentation of FOS because of a more progressive gas production
- ❖ Health benefits:
 - ❖ This high tolerability of AG makes it a potentially interesting source of fibre for consumers suffering from Irritable Bowel Syndrome (IBS).
 - ❖ Because one of the characteristics of IBS is visceral hypersensitivity, and because this pain limits the consumption of fibres by IBS sufferers, AG could be helpful for this kind of population. (As demonstrated by Feng et al 2012)

- ❖ Physiological effects on microbial community composition:
 - ❖ This experiment showed that a gradual change occurred in the microbial community and that repeated ingestions of the products are necessary to exert this effect
 - ❖ FOS exerted a lactobacillogenic effect, while AG exerted a highly specific bifidogenic effect, mainly directed to bifidobacterium longum spp
 - ❖ Also AG resulted to be effective in stimulating the growth of feacalibacterium prausnitzii, while FOS not

✦ Health benefits:

- ✦ The bifidogenic effect, especially directed to an increase of the *B. longum* population could be interesting for IBS, because as it was showed (Guglielmetti et al 2011), the supplementation of the specific bifidobacterium strains *B. Longum* MIMBb75 improved the quality of life of IBS patients in a RCT
- ✦ Moreover AG is able to increase the population of *faecalibacterium prausnitzii*, a microorganism that can exert anti-inflammatory effects. *Faecalibacterium prausnitzii* could also represent a nutritional tool for Crohn Disease and Ulcerative Colitis management (Benus et al in 2010 and Valera et al in 2013)

Twin-Shime study

The physiological effects and health benefits on SCFA, Acetate, Propionate, Butyrate

❖ Physiological effects:

- ❖ Both products gave a clear indication of prebiotic activity in increasing the total SCFA concentration
- ❖ Both products were able to change the ratio acetate-Propionate-Butyrate towards a healthier composition
- ❖ The effect of AG appeared to be more balanced with a positive effect on Butyrate production in the descending colon, while for FOS, the boost in propionate unbalanced the SCFA ratio

Twin-Shime study

The physiological effects and health benefits on SCFA, Acetate, Propionate, Butyrate

✦ Health Benefits:

- ✦ Butyrate acts as main energy source for the gut epithelium and has proven protective effects against inflammation and colon cancer
- ✦ Propionate has similar local activity in the gut as compared with Butyrate, and it is also transported to the liver where it has shown to have positive cholesterol-lowering effects and effects on glycaemic control (Wong et al 2006)

- 1) Because of his high tolerability due to gradual fermentation, and
- 2) his selectivity towards bifobacteria and feacalibacterium prausnitzii, and
- 3) his Propionate/Butyrate production improvement,

- ✦ AG presents the potential to regulate gut microbiota homeostatis that could be essential for future health-modulatory applications in : IBS, IBD, Symbiotic products, Senior diet, Sport diet, Hospital Nutrition...All that may concern the gut health
- ✦ That's why another study was carried out to investigate the AG effects on specific markers and other specific bowel troubles. The M-SHIME study

The M-Shime study

- ❖ **M for Mucosa**, because this new set up with the addition of a gut surface that provides a more ecologically-relevant gut modeling capacity by simulation of mucosa interactions
- ❖ This study dealt with the gut epithelium...
- ❖ The M-shime study results are confidential, and we are trying to patent this innovation.
- ❖ To be continued..., but the results of the Twin Shime study have been published in the March issue of Environmental Microbiology Reports.

❖ IBS/IBD: special diet:

- 20 % of the world population is impacted by IBS
- 5 millions people are suffering of IBD in the world, mainly in industrial countries, in north-west Europe and North America

❖ Senior diets:

Elders have digestive disorders, their gut microbiota need to be rebalanced in *B. longum*...



❖ Formulation on synbiotics:

- With *B. longum* for example...
- A lot of application like atopic eczema treatment, immunity, bacterial infections...



❖ Sport diets:

Elde because sport diet may need fibers for a healthy gut



❖ Foods for special medical purpose:

For people that need special nutrition, in hospitals or because of disease side effects. Pharmaceutical and food companies are involved like Abbott, Nestlé, Danone, Lactalis...

Foods for Special Medical Purposes is a market with high potential development



Because we are not what we eat, but we are what our microbial community digest, AG could be helpful to regulate our gut microbiota homeostatis.



Thank you for your attention
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