Dietary fibers are not born equal: qPCR to define prebiotic properties

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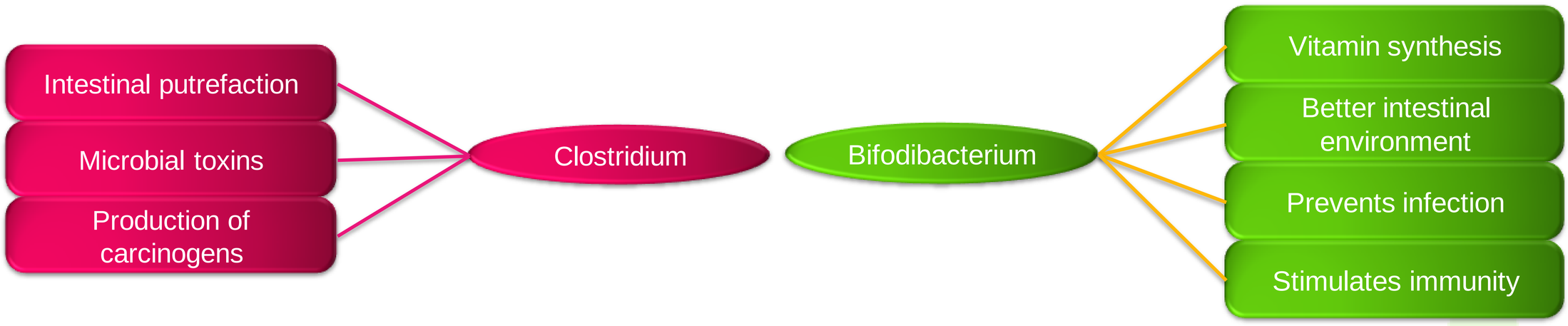
Prebiotics have been defined by Roberfroid et al (2004) as selectively fermented ingredients that allow specific changes , both in the composition and activity of the gastrointestinal microflora that confer benefits upon host well being and health .

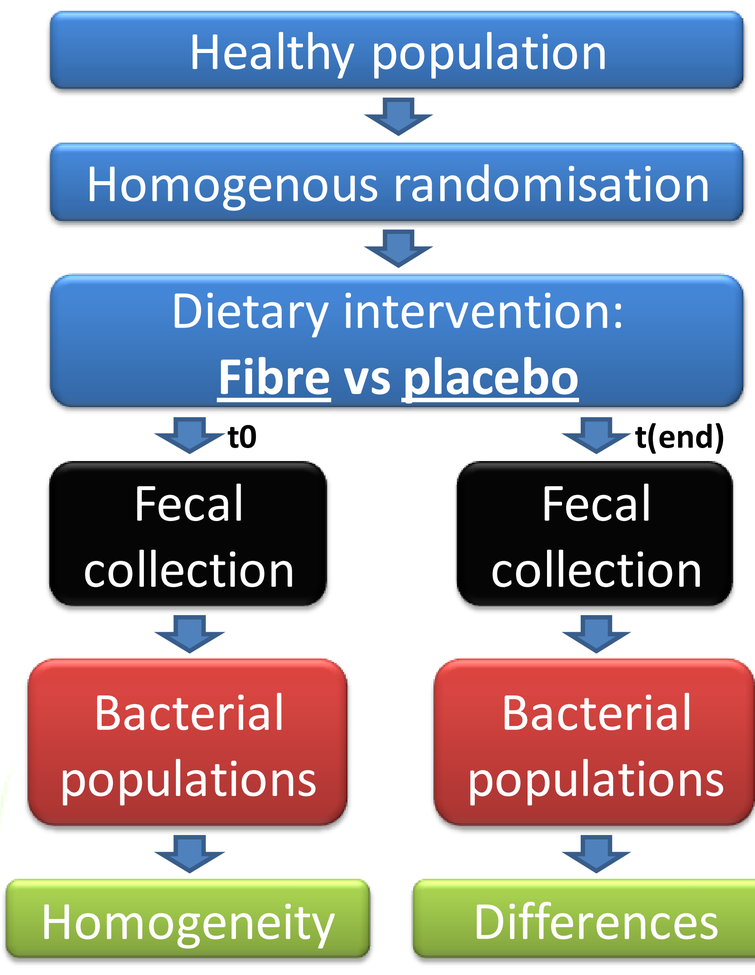
Most researchers consider that changes in the composition of gut microflora can be characterised by an increase in probiotic bacteria (eg. **Bifidobacterium**, Lactobacillus) and/or decrease in pathogenic bacteria (eg. Bacteroides, **Clostridium**). Similarly, changes in the bacteria activity is often characherised by a **butyrogenic** activity.

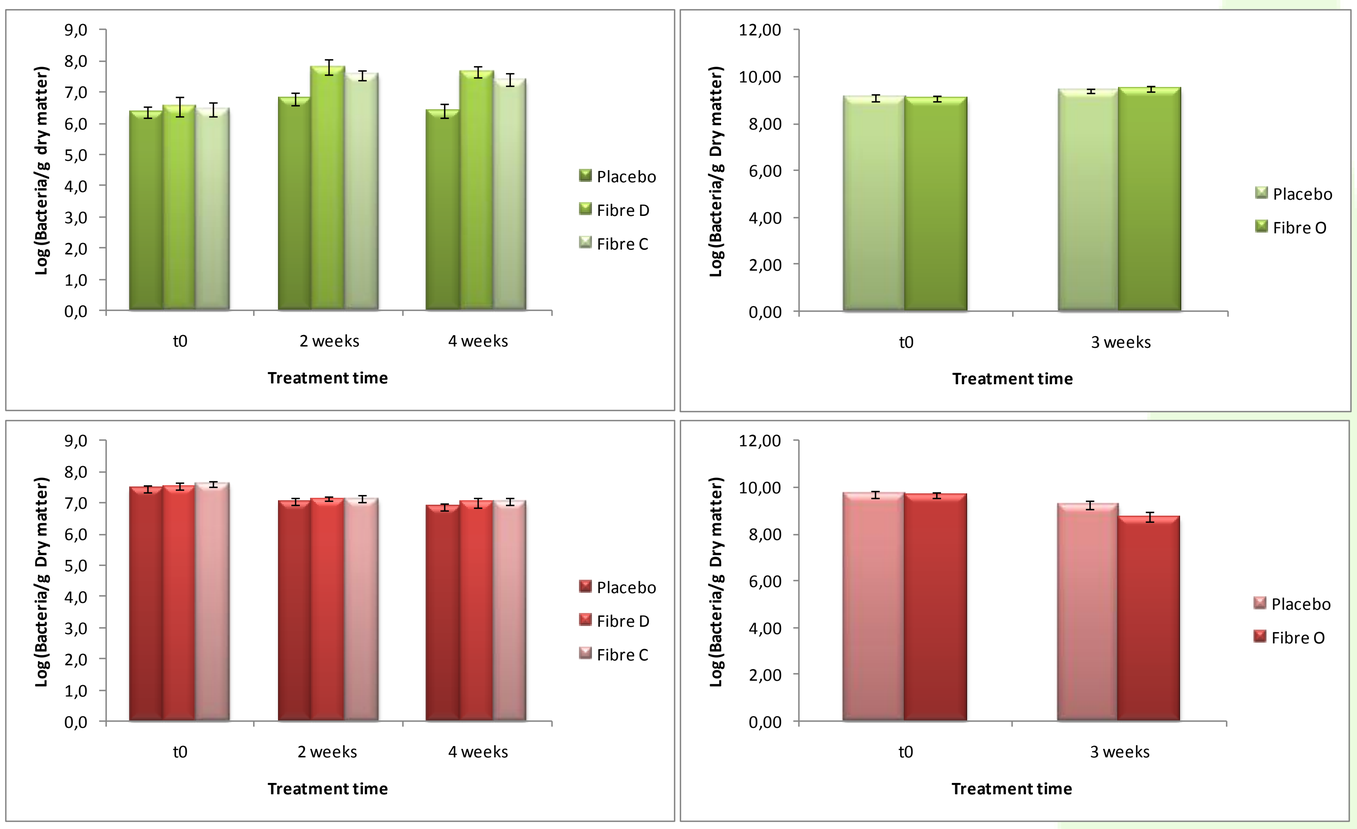
We present here two clinical trials investigating prebiotic potential of dietary oligosaccharides. In each of those studies *Bifidobacterium* and *Clostridium* were amplified using qPCR and quantified against standard curves.



EXPERIMENTAL PROTOCOL: Subjects were fed a fibre-rich diet for 2 to 4 weeks. Three Fibres were tested against a placebo.

Fresh stool samples were collected, bacterial DNA extracted using DNA stool mini kit (Qiagen) and amplified using Taqman technology for specific bacterial strains.





RESULTS: The three fibres do not have the same prebiotic potential:
Fibre C and Fibre D induce Bifidobacterium growth and do not have any significant effect on Clostridium.
Fibre O inhibits Clostridium proliferation but does not have a bifidogenic activity.

CLASSIFICATION OF DIETARY FIBRES: A large number of dietary fibers have been investigated in human studies with the objective of determining their prebiotic potential. Delzenne et al (2002) proposed the summary (table below) of the state of knowledge in 2002, clearly underlining the fact that not all fibres, whatever their structure or size, are qualified prebiotics.

CLASS OF COMPOUNDS	EXAMPLE	PREBIOTIC EFFECT[A]	EFFECT ON COLONIC/FECAL FLORA	DOSE AND DURATION OF TREATMENT
Oligosaccharides				If human studies are available
Fructans	Chicorey root inulin, oligofructose, synthetic fructan	+++	+bifidobacteria, lactobacilli -bacteroides, clostridia…	4-40g/day-1 to 5 weeks
Galacto-OS (GOS)	Trans GOS, natural GOS from human milk	++(+)	+bifidobacteria, lactobacilli	3to 10g/d
Glucose-based oligosaccharides	Dextran and oligodextrans	++	+bifidobacteria, lactobacilli	/
	Polydextrose	++(+)	+bifidobacteria, lactobacilli -bacteroides	4 to 12g/d.
	Isomalto-oligosaccharides	++(+)	+bifidobacteria	13.5g/d for 2 weeks
Xylooligosaccharides		++	+bifidobacteria	/
Soy-bean oligosaccharides	Raffinose - stachyose	++(+)	+bifidobacteria + bacteroides/eubacteria (low dose) -clostridia	3 to about 10g/d for 3 weeks
Other oligosaccharides	Arabinoxylans (rye, wheat bran, wheat flours)	+	?	?
Others				
Resistant starch	Type 2 and 3 From beans, potatoes, banana, processed food	+	+bifidobacteria (pigs)	?
b-glucan	From oat bran	+	?	?
galactomannan polymer	From partially hydrolized guar gum	+(+)	+bifidobacteria, lactobacilli	7g/d for 2 weeks

qPCR: Molecular qPCR technology allows to investigate a large number of bacterial species with a variable level of specificity. Indeed we can target different levels, from the wider (bacterial families contaning hundreds of species) to the more specific sub-species, even targeting genetic trends if necessary.