

**Prebiotics in foods and their beneficial effects**  
A monograph  
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## Prebiotics (Gibson and Roberfroid 1995)

Non digestible food ingredient that is known to selectively stimulate the growth and activity of one or more beneficial bacteria in the colon and which in turn improves the host health status.

# Pre requisites for prebiotics

- ◆ **Able to withstand the digestive processes, before they reach the colon**
- ◆ Preferably persist throughout the large intestine such that their benefits to be conferred upon the essential microbiota (Gibson et al., 2004).

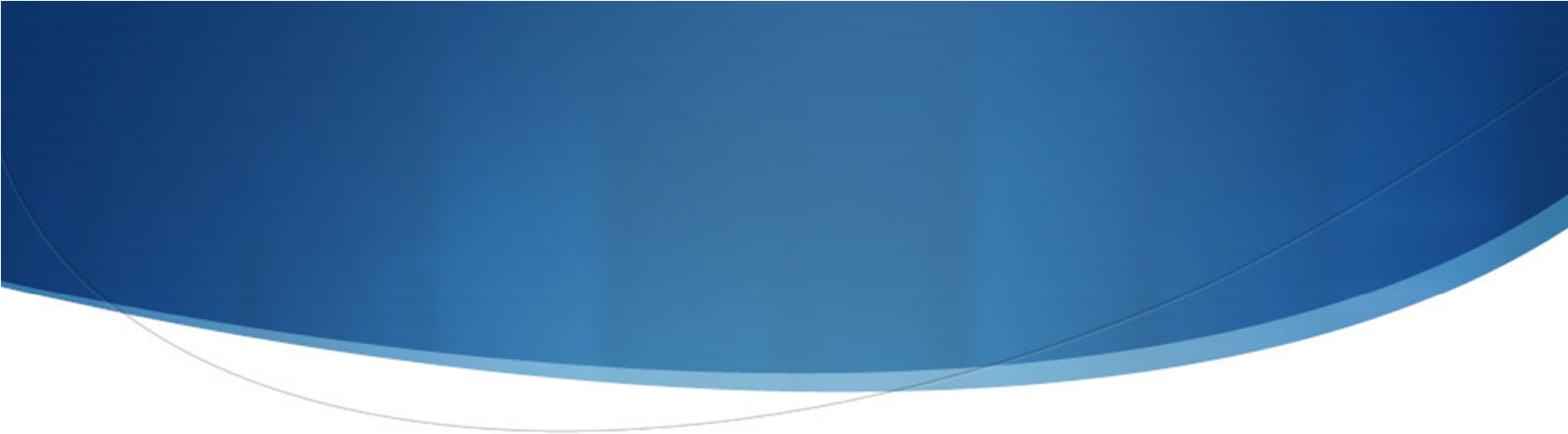
# Prebiotic oligosaccharides

- Contains fructose chains with a terminal glucose
- Typically consist of 10 or fewer sugar molecules
- Examples
  - Fructo-oligosaccharides (FOSs)
  - Inulin
  - Galacto-oligosaccharides (GOSs), And
  - Soybean Oligosaccharides.



# Oligosaccharides

- ◆ Essential prebiotics
- ◆ Low molecular weight carbohydrates
- ◆ Sources of carbon for the colonic bacteria (Gupta and Kaur., 2000).
- ◆ Induce fermentation
- ◆ Initiate the production of short chain fatty acids
- ◆ Prevent the growth and multiplication of pathogenic microorganisms (Morisse et al., 1993).

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- ◆ Abundantly seen in plants – Inulin and Oligo fructose
  - ◆ Small quantities in Human Milk (HMO)
  - ◆ Major HMO is 2'Fucosyllactose (2FL)
  - ◆ Present in Colostrum
  - ◆ Isolated and used as supplements

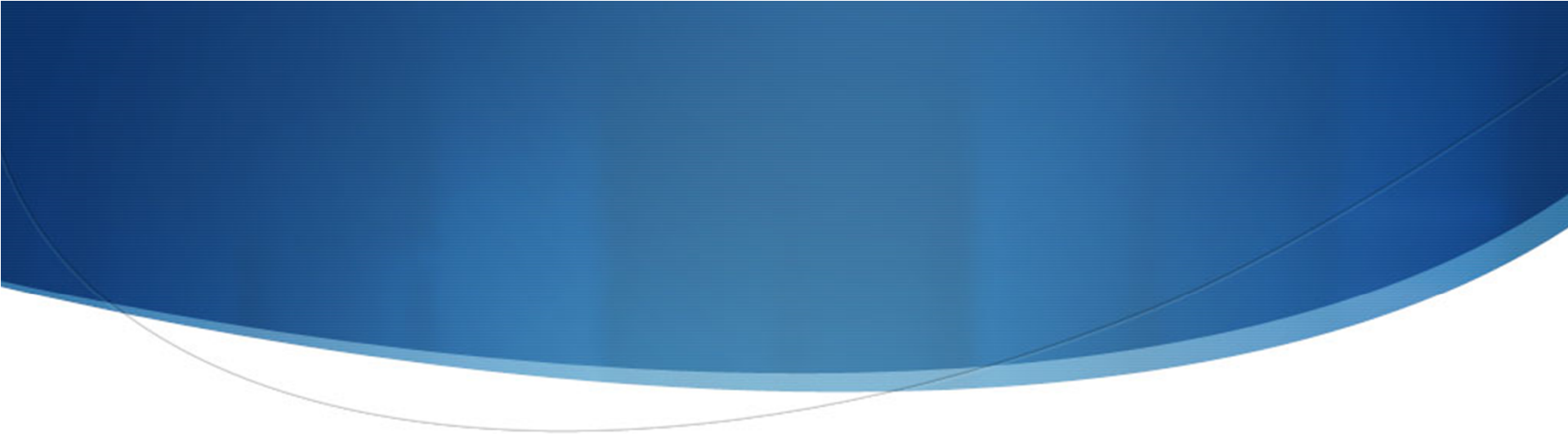
# Chain length

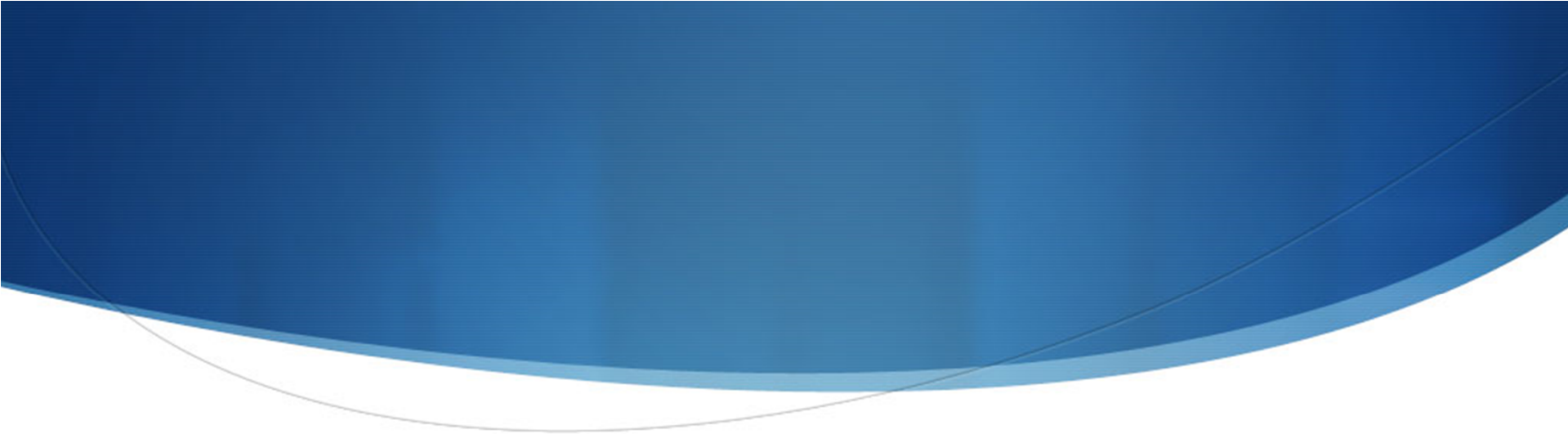
- ◆ Short chain FOS- Wheat , Onion, Banana
- ◆ Medium chain- tubers, garlic and Jerusalem artichoke
- ◆ Long chain- in globe artichoke and chicory (Inulin)
- ◆ Chicory root is the best source for inulin and contains about 70-80% of its dry

# Prebiotic sources from Indian foods

- ◆ Millets and Pulses (5 to 12%)
- ◆ Germination reduces prebiotic content of pulses-
- ◆ However, an enhanced formation of bifidobacteria colony was recorded for fermented food products than for natural ones, in high-fat diet models (Wang et al., 2015).



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- ◆ Total oligosaccharides in different pulses range from 70.7-114.9 mg/g (dry weight basis)
  - ◆
  - ◆ The beans contain stachyose, and verbascose as predominant oligosaccharides,

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- Majority of pulses contain  $\alpha$ -galactosides which are characterized by a (1 - 6) links between the galactose moieties (Han and Baik 2006).
  - These are the second most abundant soluble carbohydrates after sucrose and are classified as raffinose (trisaccharide), stachyose (tetrasaccharide) and verbascose (pentasaccharide) based on their structure (Hoveer et al., 2010).

# Natural Oligosaccharides or Prebiotics from food sources

- | Class      | Source  |
|------------|---|
| Vegetables |   |
|            | Jerusalem artichokes (116mg/g) <sup>\$</sup> , chicory (70% dry weight), garlic (32mg/g) ,  |
|            | onion (38mg/g), leek (30mg/g), shallots, spring onion, asparagus,   |
|            | beetroot (10mg/g) ,fennel bulb, green peas (7mg/g), snow peas, sweet corn (3mg/g) and Savoy cabbage(6mg/g). (Inulin and arabinoxylan) |

# Natural Oligosaccharides or Prebiotics from food sources

## ◆ Legumes

◆ Chickpeas (12mg/g), lentils (11.5mg/g), red kidney beans (15mg/g), baked beans (1mg/g), soybeans (23mg/g).

◆ (Raffinose and  $\alpha$ -Galactosidase )

## ◆ Fruit

◆ Custard apples (1.5mg/g), nectarines, white peaches (2mg/g), persimmon, tamarillo, watermelon (1mg/g), rambutan, grapefruit, pomegranate. dry fruits (eg. dates, figs)(1mg/gm)

# Natural Oligosaccharides or Prebiotics from food sources

- ◆ **Cereals**

- ◆ Wheat bran (5.3mg/g), Oats (5mg/g) :

- ◆ Ragi (2mg/g)

- ◆ Rice (0.8mg/g), Hulled Barley (0.7mg/g), Bajra (0.9mg/g), Jowar (0.3mg/g),). (Raffinose and arabinoxylan )

# Natural Oligosaccharides or Prebiotics from food sources...

- ◆ **Nuts and seeds** (Raffinose and arabinoxylan)
- ◆ Cashews (28mg/g), pistachio nuts (13mg/g)
- ◆ **Other**
- ◆ Human Breast milk\*(2'FL)
  
- ◆ **Source:** Longvah et al., 2017; [Jantscher-Krenn E](#) and Bode et al., 2012\*. Slimestad et al., 2010,; Samanta et al., 2007

# Types of oligosaccharides as prebiotics naturally available or synthesized commercially

<i>Oligosaccharide</i>	<i>Naturally occurring</i>	<i>Synthesized</i>
Fructo- oligo	Fruits and vegetables, onions, banana, garlic etc.	from saccharose
Galacto	Human milk	from lactose
Lactulose	-----	“ ”
Malto- oligosaccharide	-----	from Starch
Xylo-oligosaccharide	-----	from polyxylose
Stacchyose, Raffinose	Soya bean	-----
Cyclodextrins	---	from starch

Source: Murphy., 2001.

# Average consumption of FOS

- ◆ US- 1 to 3 gm/ day
- ◆ Europe 3- 11 gm / Day
- ◆ **India – computed to be between 1.5 to 2 gm/ day due to higher cereal and less pulses, fruits and Veg**



# Benefits

- ◆ *Promote gut health*
- ◆ *Reduce diarrheal episodes*
- ◆ *Stimulate gut immunity*
- ◆ *Lower cholesterol uptake*
- ◆ *Lower risk of Lower GI cancers*
- ◆ *Increase Calcium absorption*



*Thank you*