The Low FODMAP Diet for Irritable Bowel Syndrome

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Advanced Accredited Practising Dietitian
Accredited Nutritionist

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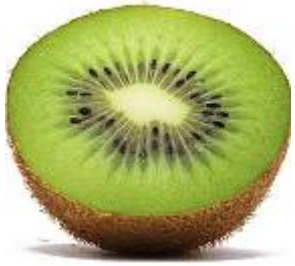

Disclosure

- Co~owner of FODMAP trademark
- Owner / Managing Director of Shepherd Works Pty Ltd dietetic practice
- Author of 7 low FODMAP diet cookbooks
- Author of low FODMAP diet shopping guide
- Consultant to food industry
- Consultant to Gluten Free Food Shows

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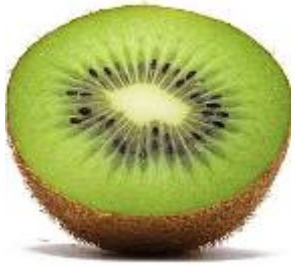

Symptoms of Irritable Bowel Syndrome

- Bloating
- Wind
- Abdominal Distension
- Altered Bowel Habits
  (diarrhoea and/or constipation)
- Abdominal Pain

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Rome III

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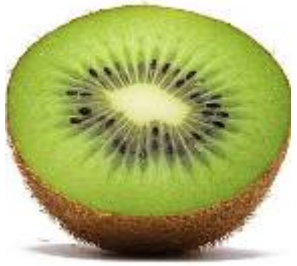

Irritable Bowel Syndrome

- Most common GI disorder, occurring in 15% of the general population
- Abdominal symptoms in absence of identifiable disease
- Pathogenesis unknown
- Chronic disorder; where symptoms can occur in episodes that vary in frequency and severity

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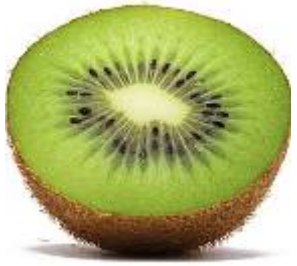

Irritable Bowel Syndrome

- Patients with visceral hypersensitivity and motility disturbances of the colon
- It is an exaggerated response of gastrointestinal symptoms
- As IBS cannot be cured, strategies for management of symptoms are encouraged

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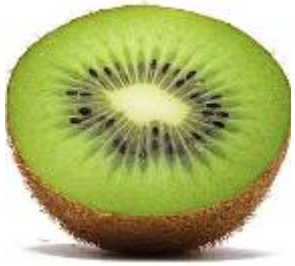

Introducing….

The Low FODMAP Diet for Irritable Bowel Syndrome

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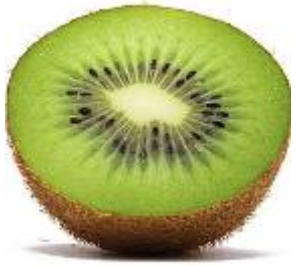

What are FODMAPs?

Fermentable

Oligosaccharides → Fructans

Oligosaccharides → Galacto-oligosaccharides (GOS)

Disaccharides → Lactose

Monosaccharides → Fructose (in excess of glucose)

And

Polyols → Sorbitol

Polyols → Mannitol

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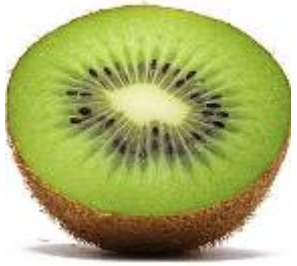

So why the Low FODMAP Diet for IBS?

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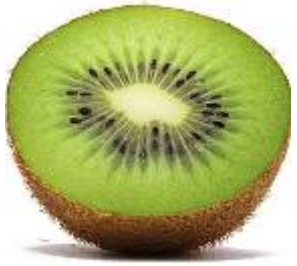

So why the Low FODMAP Diet for IBS?

- FODMAPs induce symptoms of IBS

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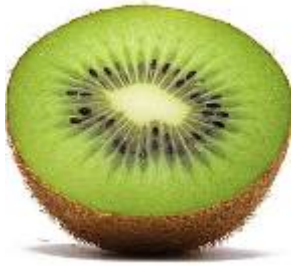

So why the Low FODMAP Diet for IBS?

- FODMAPs induce symptoms of IBS
- The mechanism of how FODMAPs cause symptoms is clear and well understood

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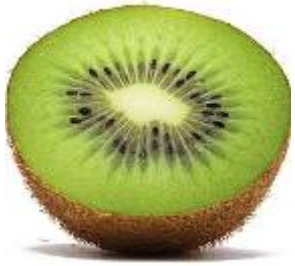

So why the Low FODMAP Diet for IBS?

- FODMAPs induce symptoms of IBS
- The mechanism of how FODMAPs cause symptoms is clear and well understood
- The Low FODMAP Diet provides symptom relief in ~75% of IBS patients

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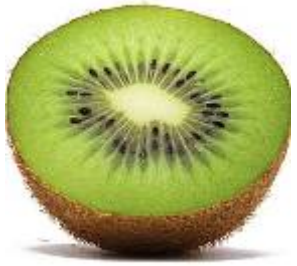

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- FODMAPs induce symptoms of IBS
- The mechanism of how FODMAPs cause symptoms is clear and well understood
- The Low FODMAP Diet provides symptom relief in ~75% of IBS patients
- The Low FODMAP Diet is sustainable – patients have continued to follow the diet since it was developed

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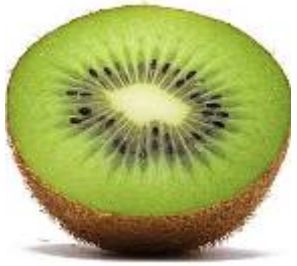

FODMAPs – Induce IBS symptoms

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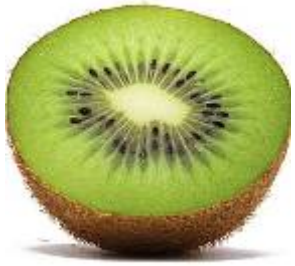

FODMAPs induce symptoms of IBS

- In a double blinded, randomised, quadruple arm, placebo controlled cross over re-challenge trial, all IBS symptoms worsened after challenge with FODMAPs *(fructose and fructans)*
- Diet was controlled and consistent throughout trial (eg. food chemicals, fat, fibre), so symptoms confirmed to be from FODMAPs

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Shepherd, SJ et al, Clin Gast Hep 2008 Jul;6(7):765-71

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Study protocol

- 25 patients enrolled 23-60yrs, 16%male
- Patients were fed the low FODMAP diet during the entire study duration (22 weeks)
- Pts consumed test substances:
  - Fructose
  - Fructans
  - Fructose & Fructans
  - Placebo (Glucose)

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Shepherd, SJ et al, Clin Gast Hep 2008 Jul;6(7):765-71

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Patients who answered “No” to the question “Were your symptoms adequately controlled” for the test drink

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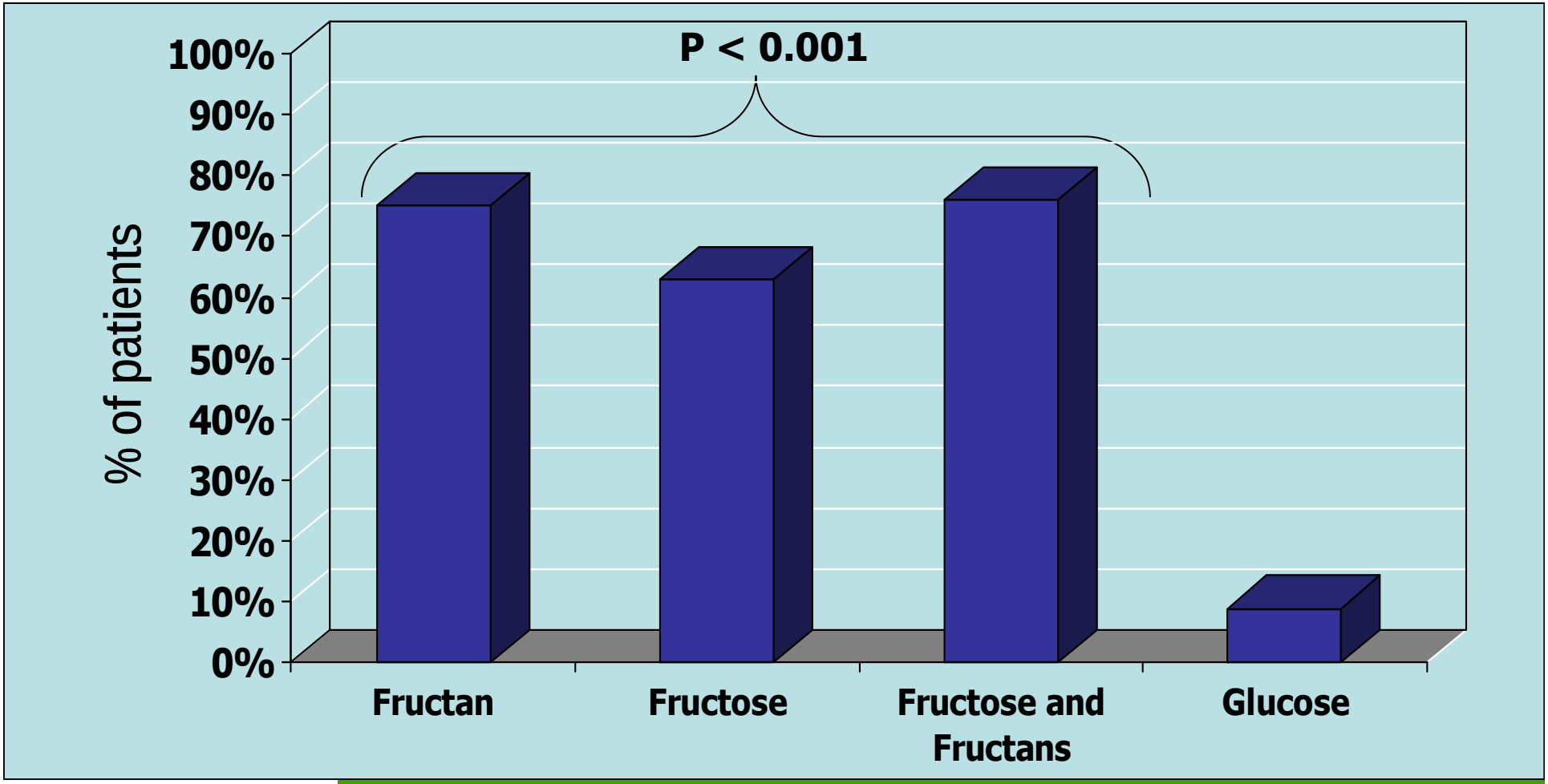
Patients who answered “No” to the question “Were your symptoms adequately controlled” for the test drink



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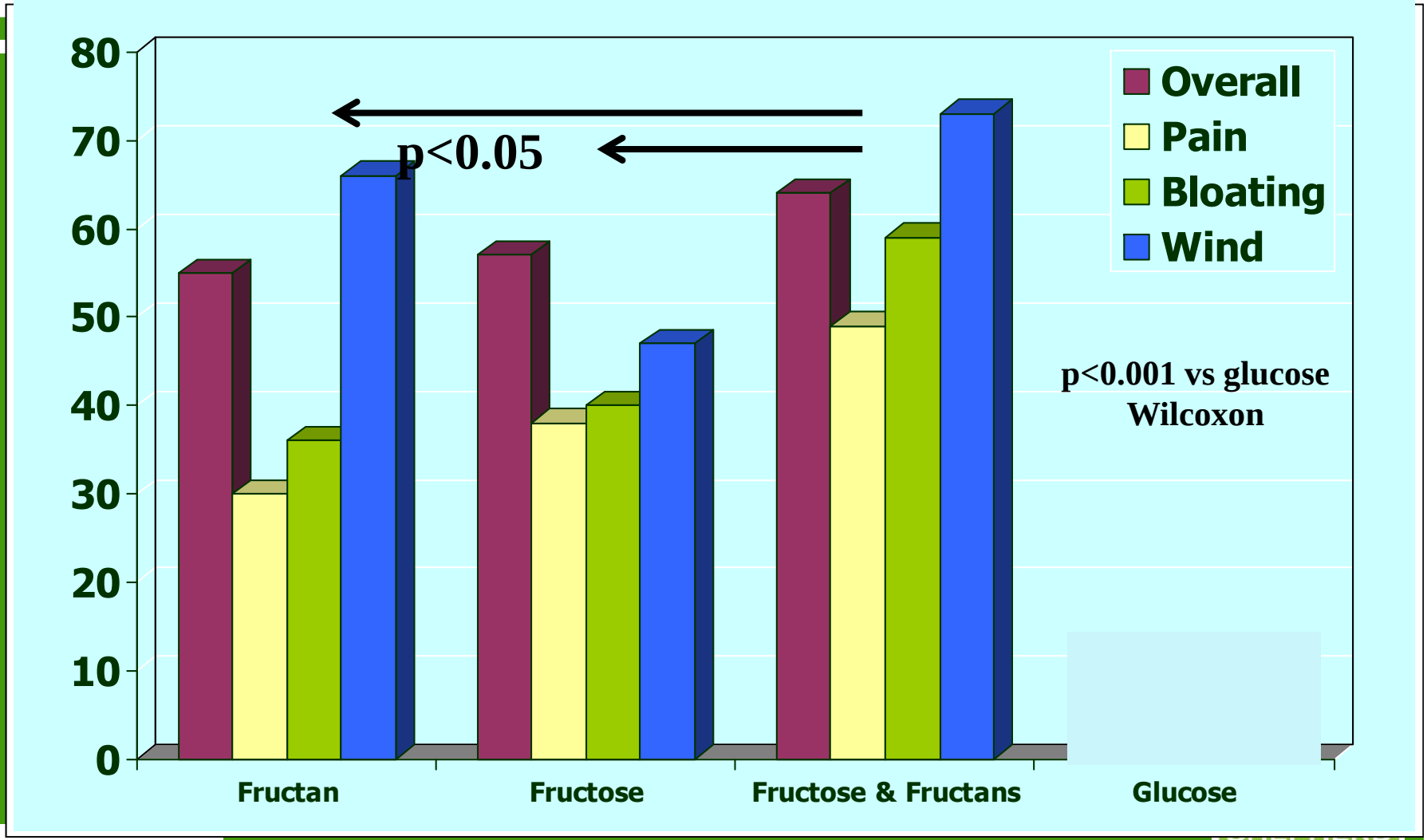
Median Symptom Scores after consuming test substances in amounts equal to Australian Diet

*Median scores on VAS



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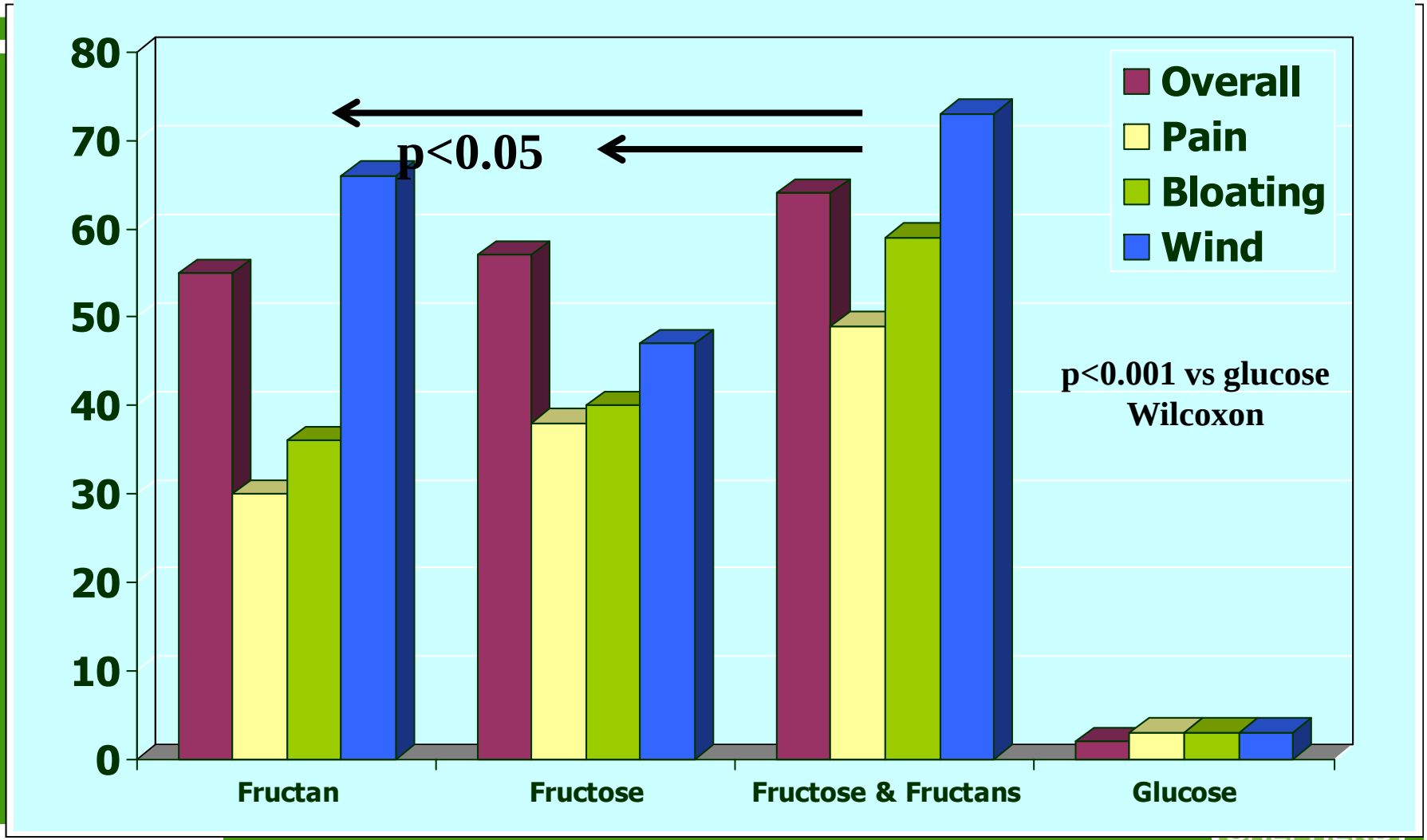

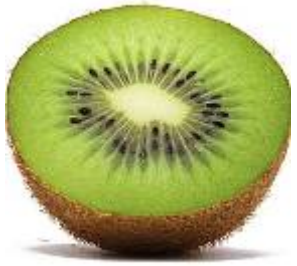

Foods containing FODMAPs

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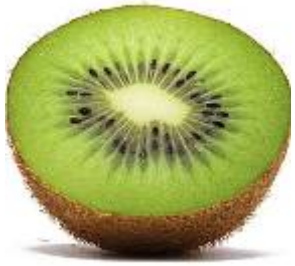


What are the problem fruits?

EXCESS FRUCTOSE

- Apple
- Cherries
- ***Mango***
- Nashi fruit
- Pear
- Watermelon

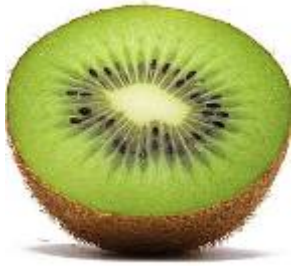
FRUCTANS

- White peach
- Persimmon
- Rambutan*
- Watermelon

POLYOLS

- Apple
- Apricot
- Avocado*
- Blackberries
- Cherries
- Longon*
- Lychee*
- Nashi Fruit
- Nectarine
- Pear
- Peach
- Plum
- Prune

*problem if eaten in large quantities



What are the problem veg?

FRUCTANS & GOS

- Artichokes (Globe)
- Artichokes(Jerusalem)
- Beetroot*
- Brussels Sprouts
- Cabbage
- Chicory
- Dandelion leaves
- Fennel*
- Garlic
- Leek
- Legumes & lentils
- Okra
- Onion (brown, white, Spanish, onion powder)
- Peas*
- Shallot
- Spring onion (white part)

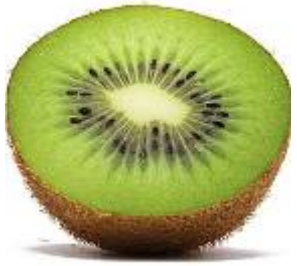
POLYOLS

- Cauliflower
- Mushroom
- Snow peas*

EXCESS FRUCTOSE

- Sugar snap peas
- Asparagus

*problem if eaten in large quantities



Examples of other foods containing FODMAPs

- Honey
- High fructose corn syrup
- Coffee substitutes (made from chicory)
- Dandelion tea
- Inulin and FOS
- Pistachio
- Artificial sweeteners (sorbitol, mannitol, xylitol, maltitol), isomalt

Note: list not complete

- Wheat based products
  - Bread
  - Pasta
  - Breakfast cereals
  - Noodles
  - Dry biscuits
- Rye and Barley based products
- Milk (Cow, Goat, Sheep) products
  - Milk
  - Yoghurt
  - Icecream
  - Soft cheeses

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FODMAPs – Confirming Mechanism of Action

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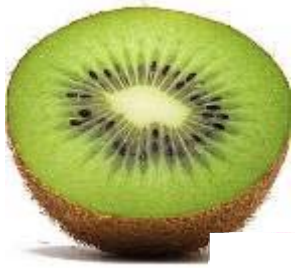
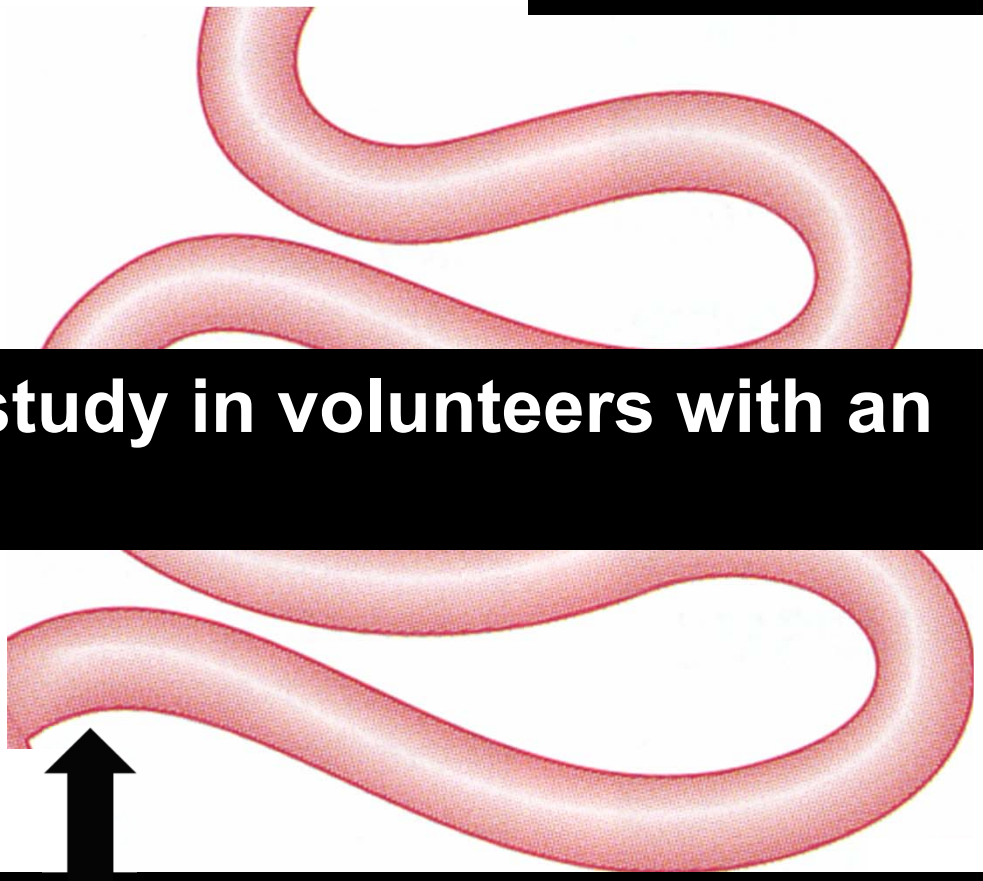
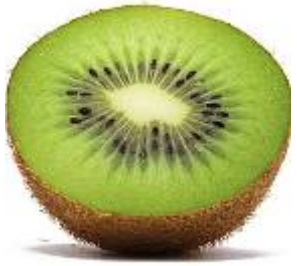


Food high or low in FODMAPs



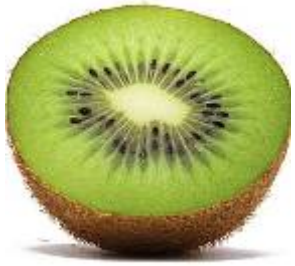
Study 1: A study in volunteers with an ileostomy

Determine what is being delivered to the large bowel (and its effect)



Aim

- To examine the hypothesis in an ileostomy model
  - that FODMAPS are poorly absorbed in the small intestine and are delivered to the large intestine
  - that they increase water load to the colon



Patients

n	10 (40% men)
Age	Mean 55 (31-78)
Years since ileostomy established	Mean 14 (1-33)
Reason for ileostomy	UC=8 (80%) CD=2 (20%)
Energy requirement	9,100 kJ/day (7,100-10,500 kJ/day)

Protocol

Diet 1

4 days

Washout period
≥2 weeks

Diet 2

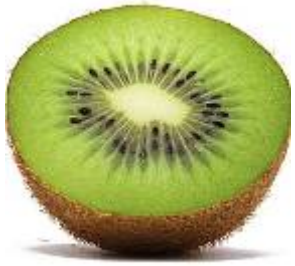
4 days

DIETS
High FODMAP vs Low FODMAP

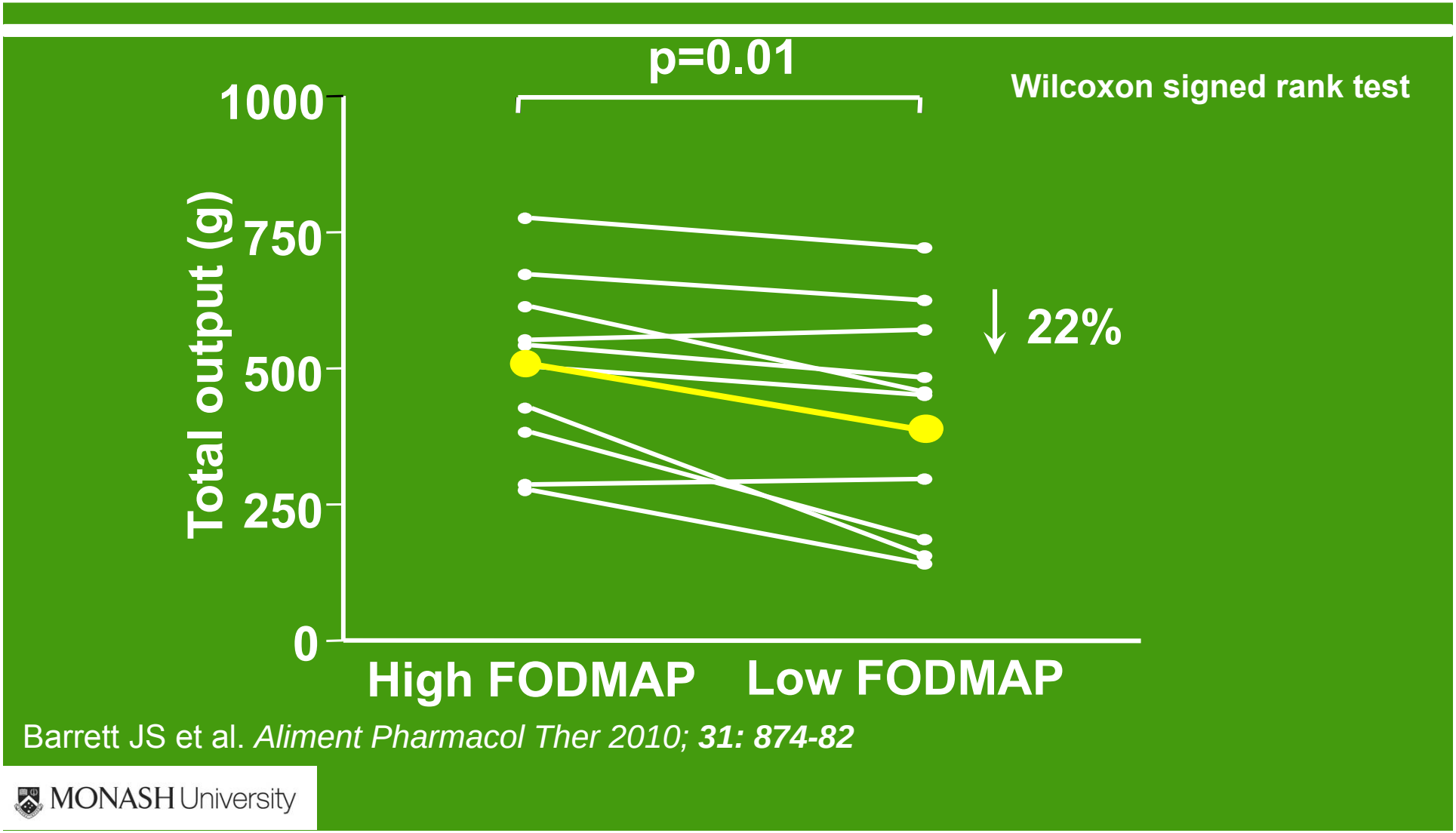
24 hour effluent collection
Visual Analogue Scale
(perception of output, symptoms)

Diet design

	Diet A = High FODMAP diet	Diet B = Low FODMAP diet
Breakfast	Rye bread with honey Weet-bix with REV milk Apple juice	GF bread with vegemite Rice flakes, rice bran, LF milk Orange and lemon cordial
MT	Pear and mango fruit snack Extra chewing gum	Mandarin PK chewing gum
Lunch	Tuna and salad on rye bread US coke	Ham, cheese, tomato on GF bread Lemonade
AT	1 tub Vaalia apricot yoghurt Extra chewing gum	1 tub lactose free berry yoghurt PK chewing gum
Dinner	Lasagne and salad	Gluten free lasagne and salad
Supper	Ecco drink	Hot chocolate with lactose free milk



Total daytime output



Barrett JS et al. *Aliment Pharmacol Ther 2010;* ***31: 874-82***

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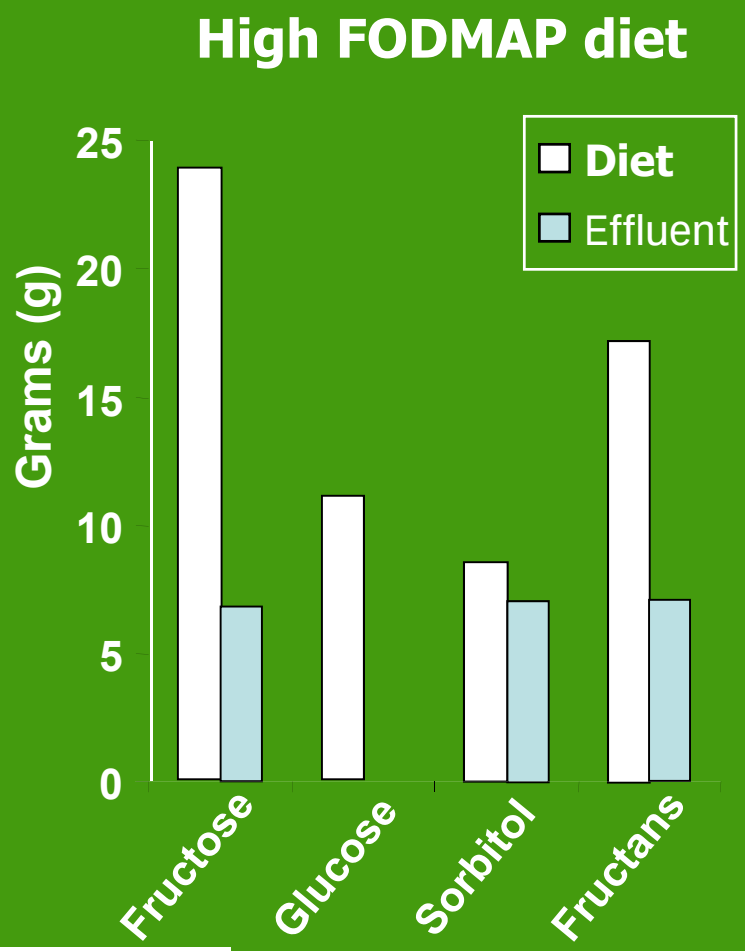
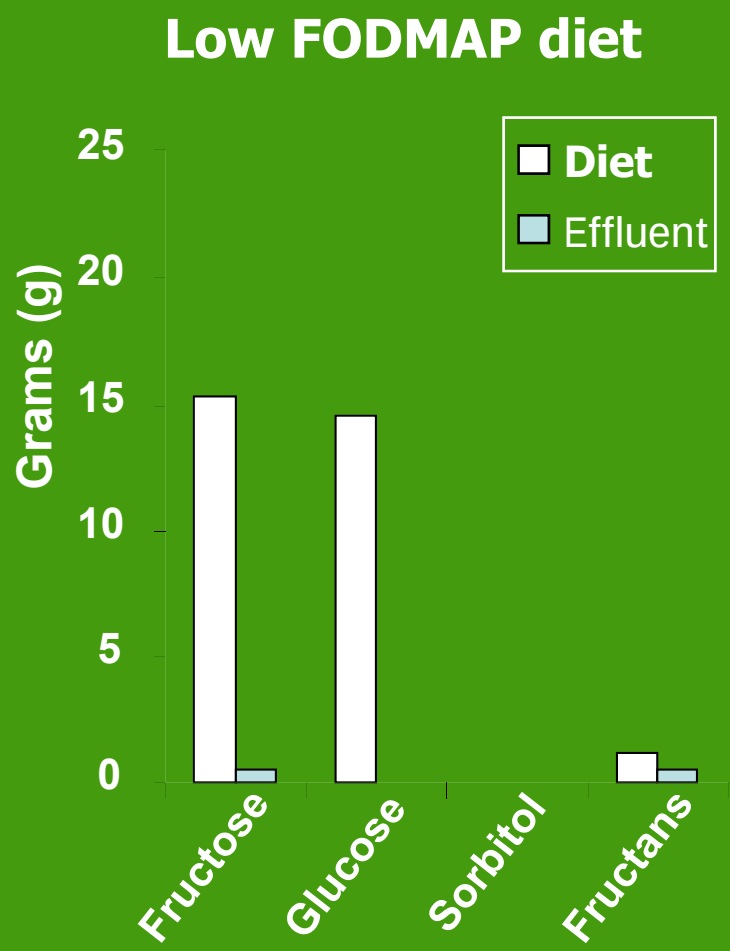
FODMAP content of diet and ileostomy output





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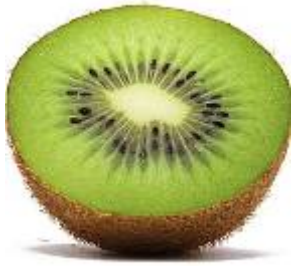
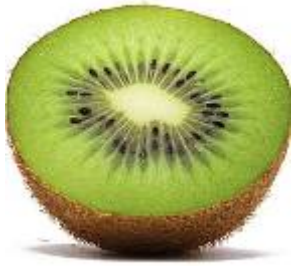
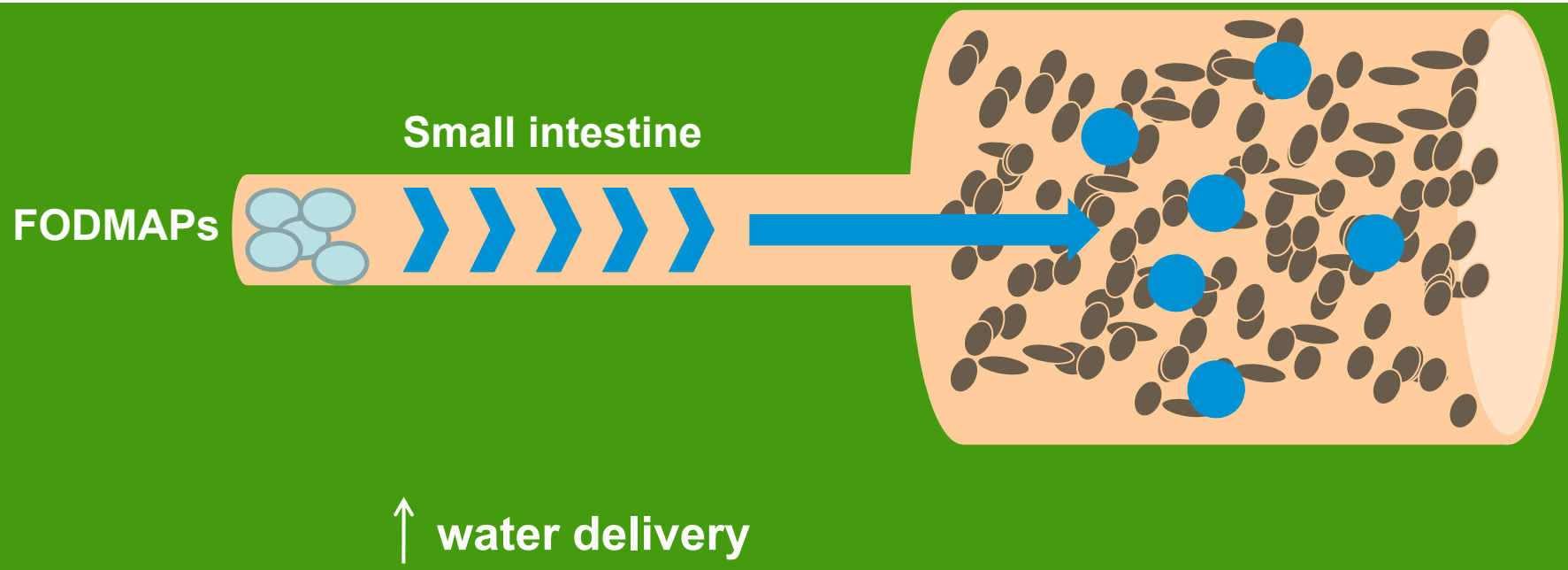


How FODMAPs cause luminal distension

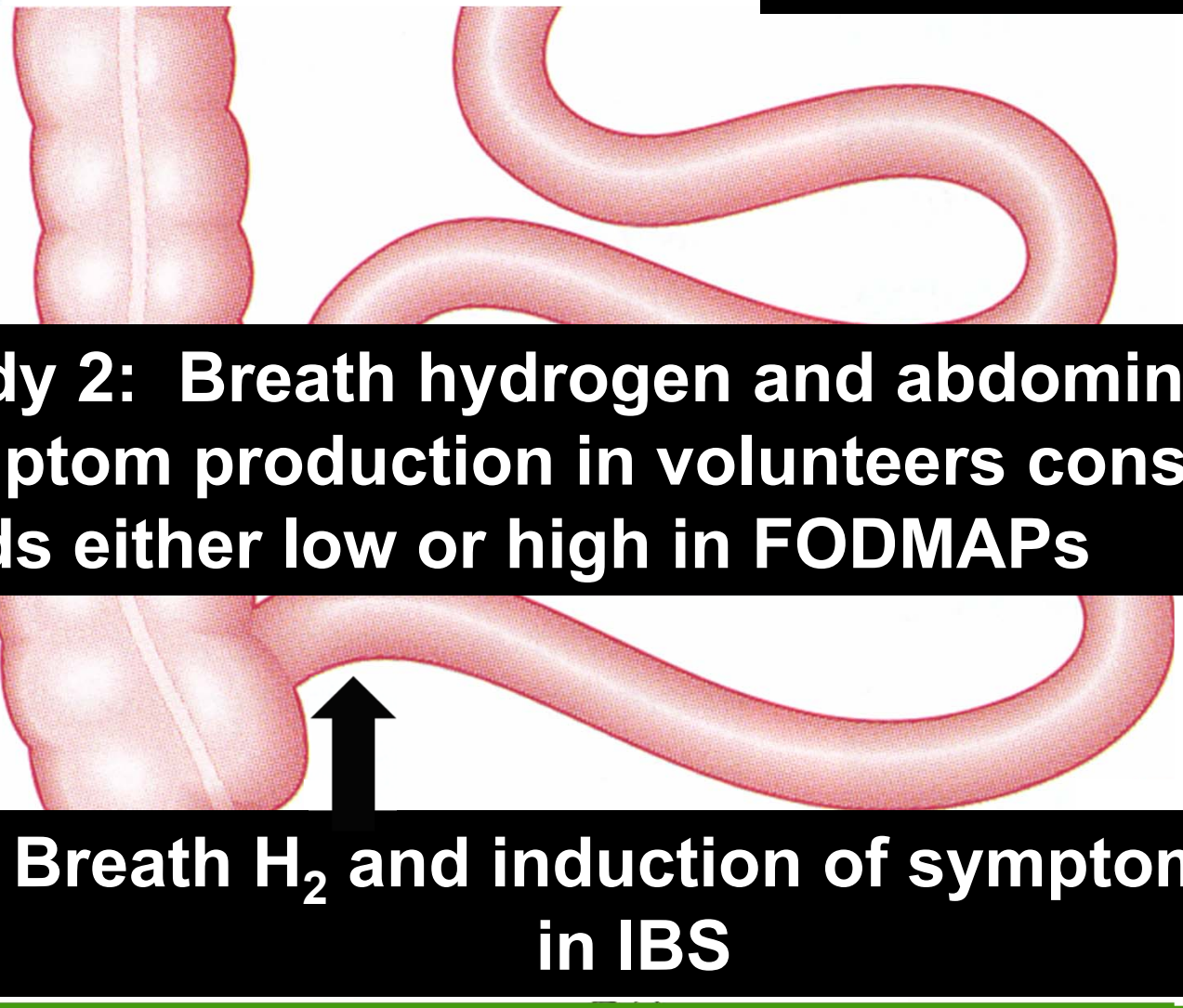
- Poorly absorbed in the small intestine and are delivered to the large intestine
- Small, osmotically-active molecules increasing water load to the colon resulting in motility disturbances (diarrhoea and faecal urgency)



Mechanism of action of FODMAPs

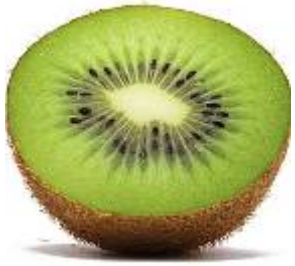


Food high or low in FODMAPs



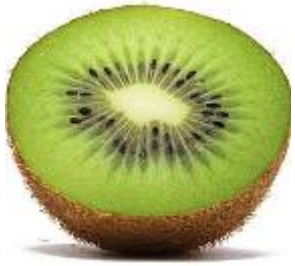
Study 2: Breath hydrogen and abdominal symptom production in volunteers consuming foods either low or high in FODMAPs

Breath H_2 and induction of symptoms in IBS



Aim

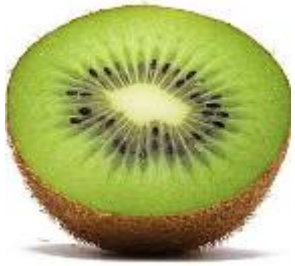
To compare breath H_2 production, & induction of gastrointestinal symptoms in individuals with IBS and healthy controls after the consumption of diets high or low in FODMAPs



Study Design

- Randomized, single blinded, crossover intervention study
- Subjects:

	IBS (Rome III)	Healthy Controls
Age (mean ± SE)	39 ± 3 yrs	36 ± 5 yrs
Gender	13 female (87%)	9 female (60%)



Study Protocol

≥ 7 day washout

Baseline

Low FODMAP diet

High FODMAP diet

Symptom diary

Symptom diary

Hourly breath collection (13 h)

Hourly breath collection (13 h)

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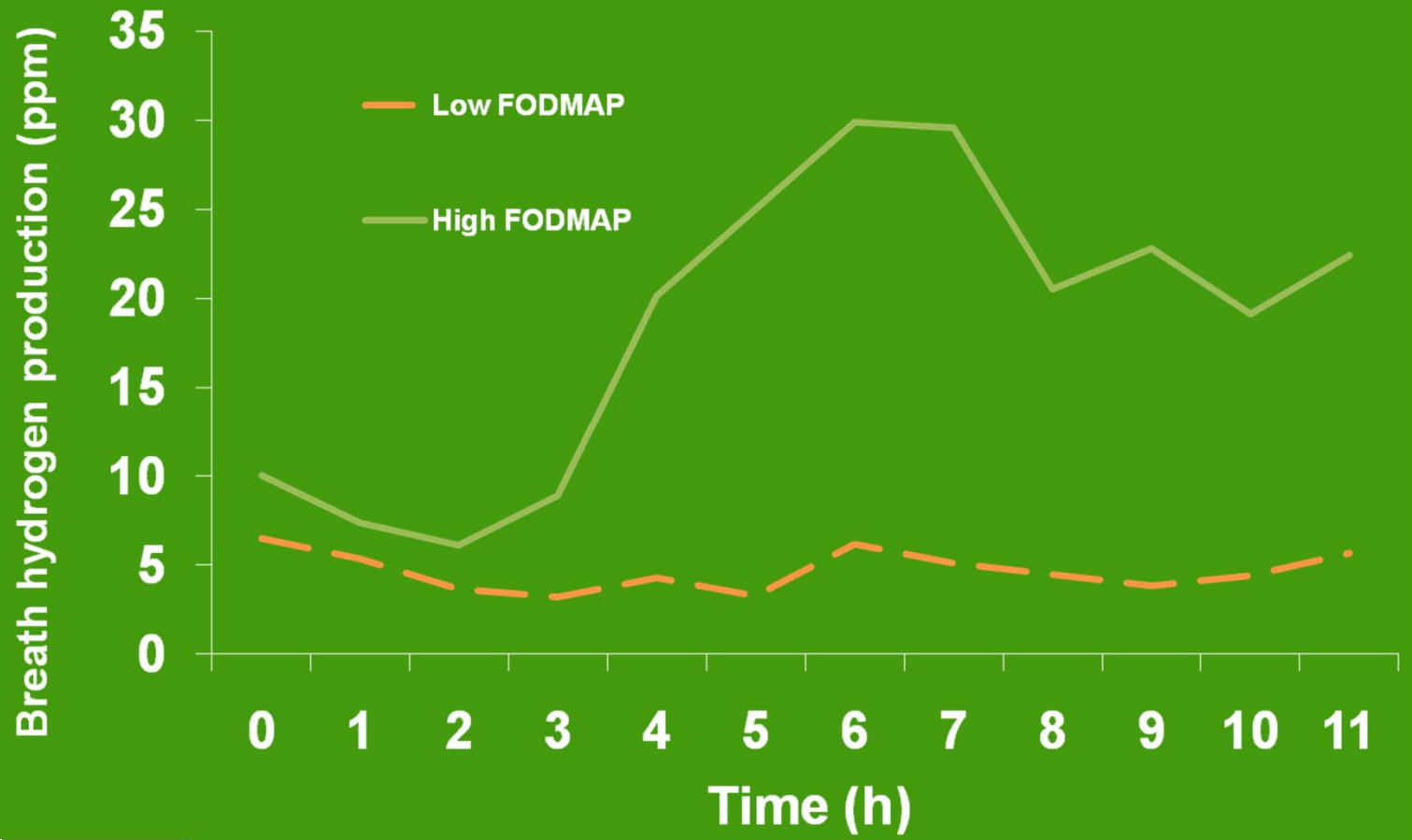
Influence of FODMAP intake on breath hydrogen production



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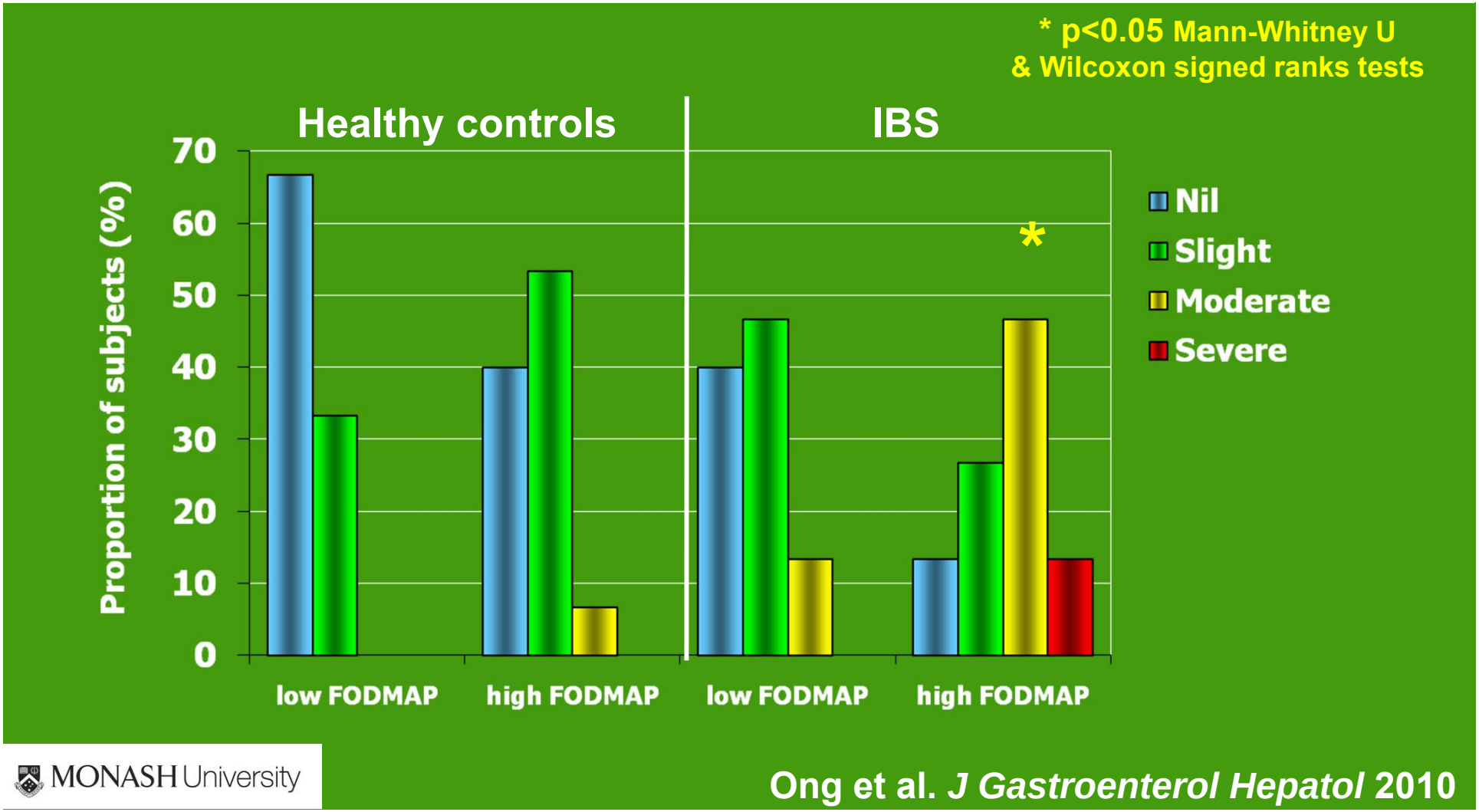
Ong et al. *J Gastroenterol Hepatol* 2010

Abdominal pain



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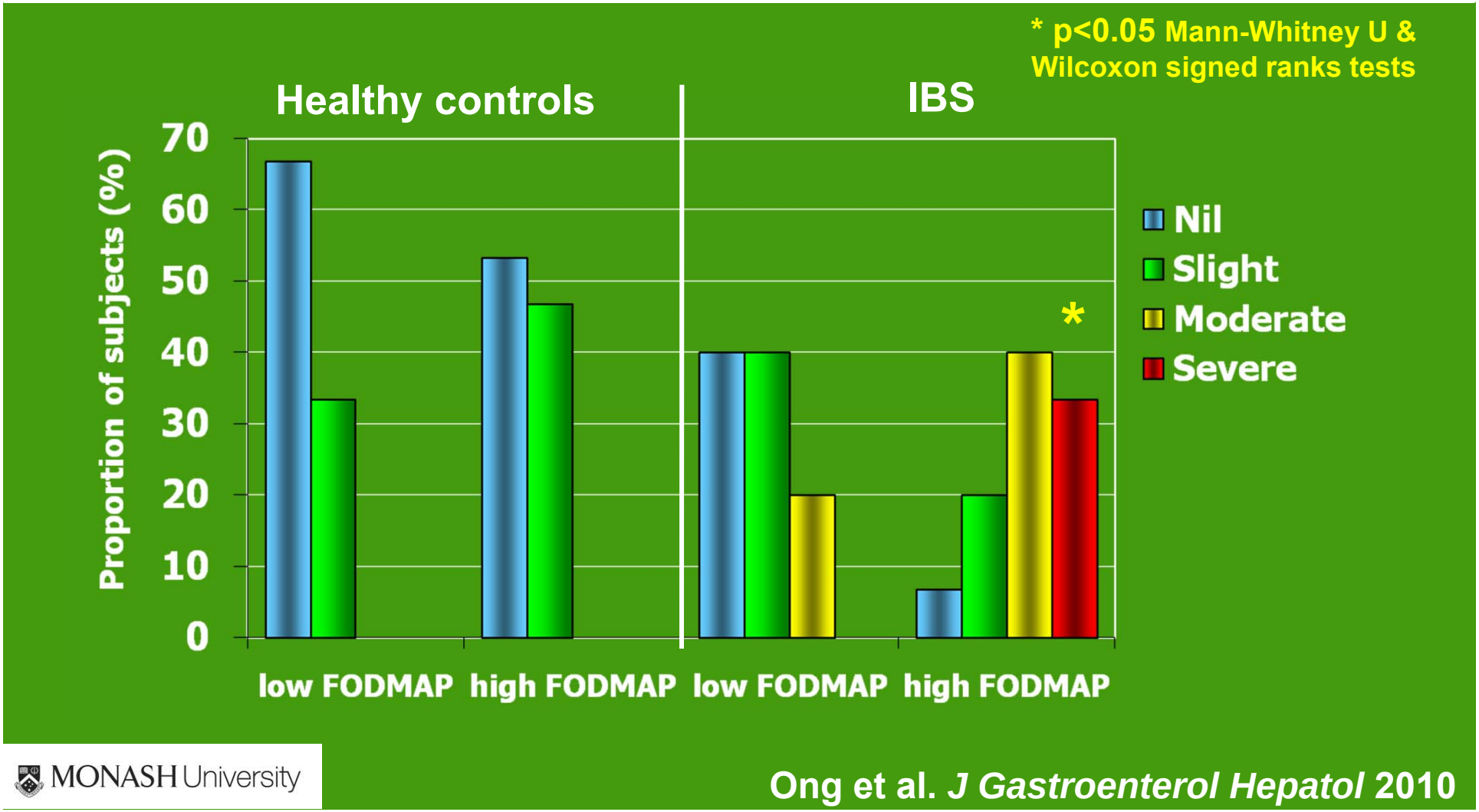
Bloating



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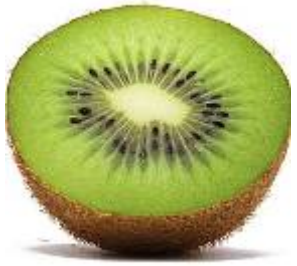
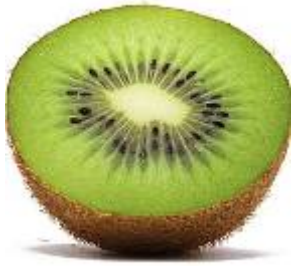
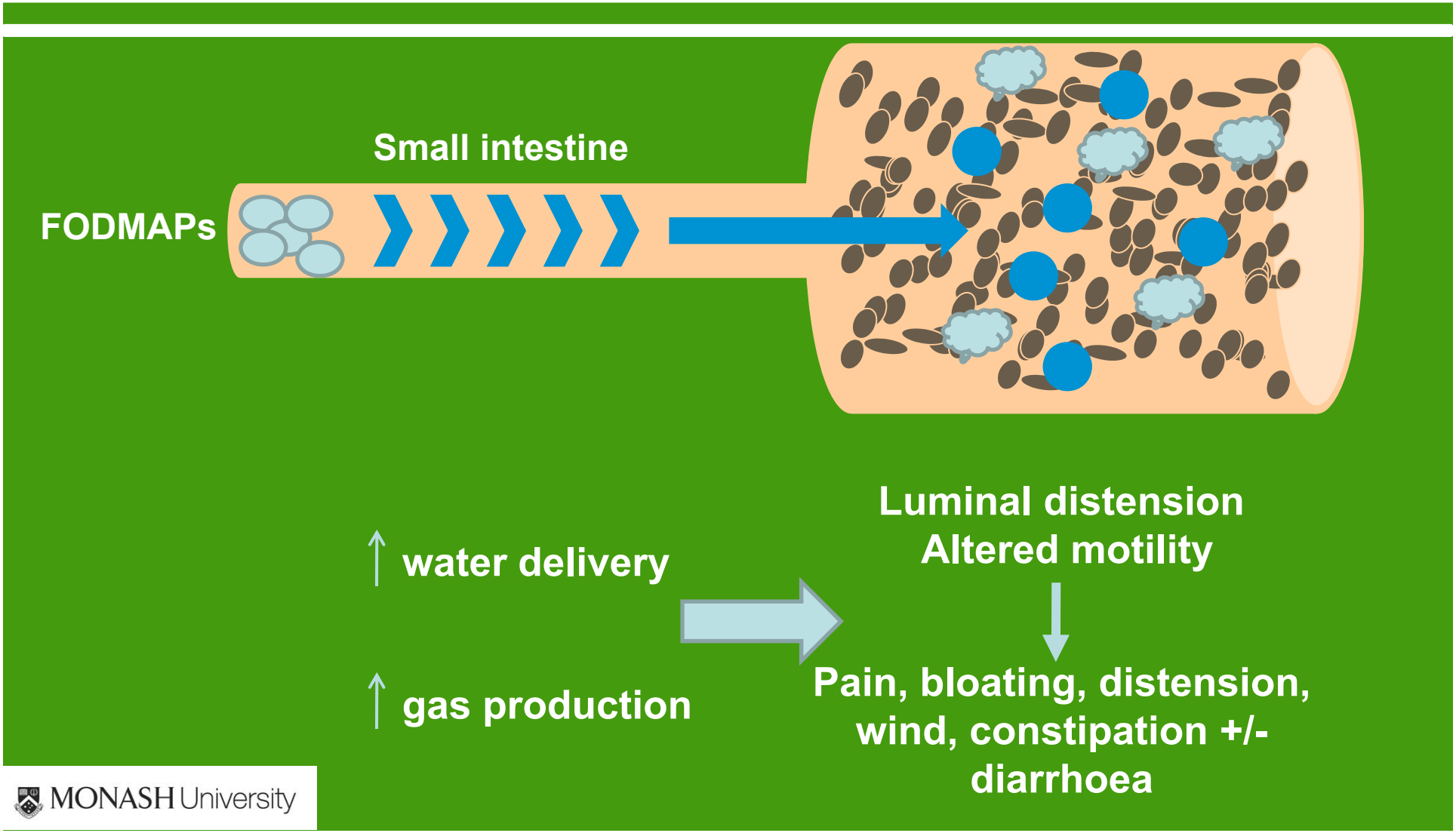


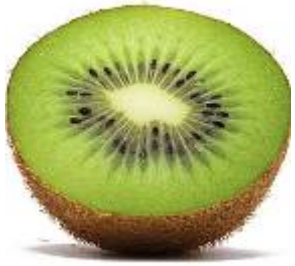
How FODMAPs cause luminal distension

- Poorly absorbed in the small intestine and are delivered to the large intestine
- Small, osmotically-active molecules increasing water load to the colon resulting in motility disturbances (diarrhoea and faecal urgency)
- Rapidly fermented by colonic bacteria resulting in gas production
- Induce symptoms in patients with IBS not healthy controls



Mechanism of Action





Implications

- Data provide strong evidence to support low FODMAP diet for people with IBS

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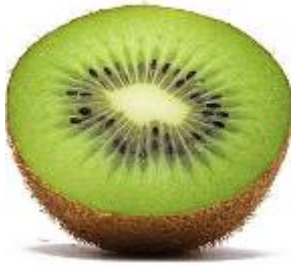

FODMAPs IN DETAIL

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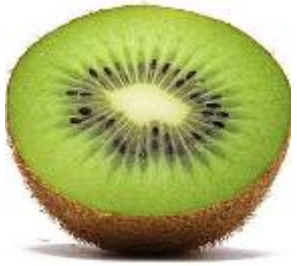

FODMAPs as dietary triggers for IBS

- Some FODMAPs are poorly absorbed in some of us
  - Fructose
  - Lactose
  - Polyols
- Some FODMAPs are not absorbed in everyone
  - Fructans
  - GOS

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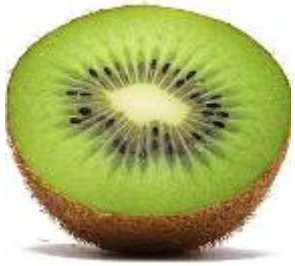
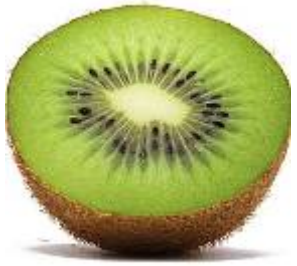


Fructose

- Monosaccharide (F)
- Common sources:
  - Fruits (eg apples, pears, watermelon)
  - Honey
  - High fructose corn syrup (sweetener)



Fructose Malabsorption

- Fructose absorption
  - low-capacity glucose-independent facilitated transport, and
  - high-capacity glucose-dependant fructose co-transport

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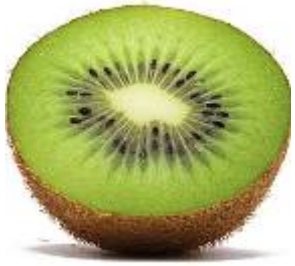

Fructose Malabsorption

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- Fructose Malabsorption is characterised by an impaired *low capacity glucose-independent facilitated transport* in the duodenum

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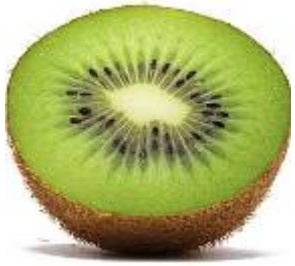

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- Fructose Malabsorption is characterised by an impaired *low capacity glucose-independent facilitated transport* in the duodenum

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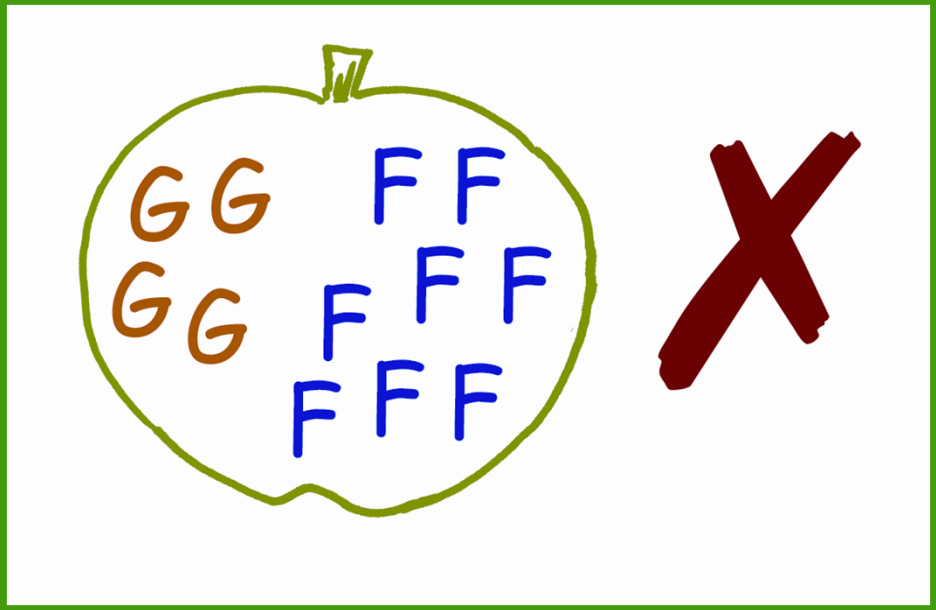
Fructose Malaborption

- Problem fruits include those that contain more fructose than glucose



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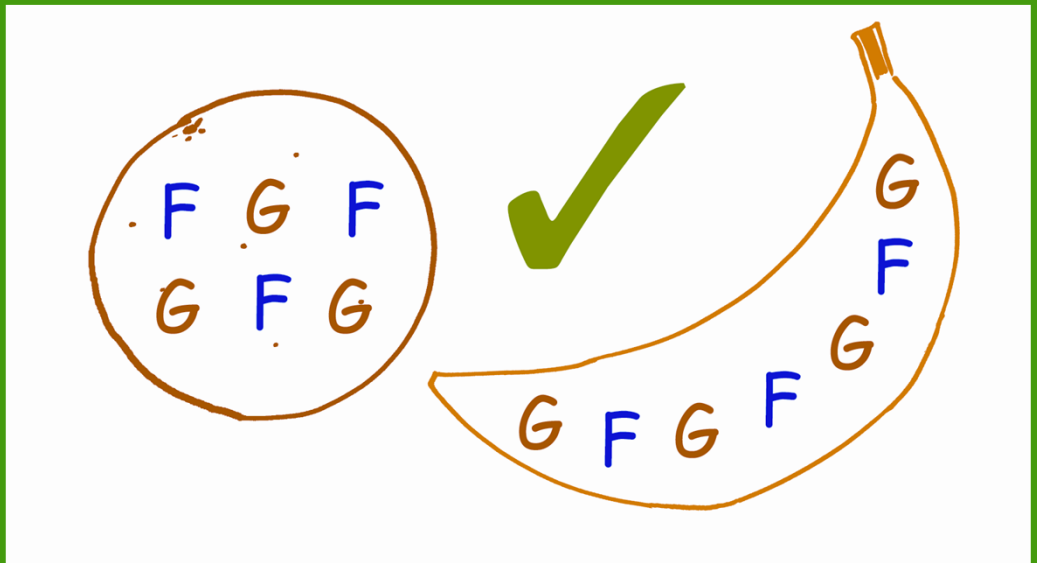
Fructose Malabsorption

- Foods that are in balance between fructose and glucose are suitable.
- Foods that have more glucose than fructose are suitable.



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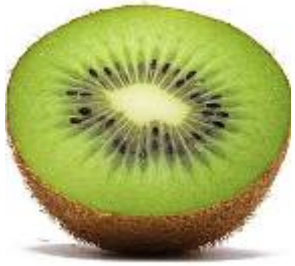

Fructose Malabsorption

- Fructose given as sucrose, or in equimolar combination with glucose, is well absorbed.

- Fructose potentially malabsorbed
  - When fructose is consumed in excess of glucose; ie “excess fructose”

Only a FODMAP if fructose malabsorbed

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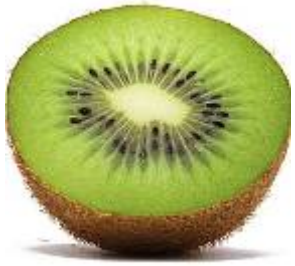

Foods with problem amounts of excess fructose

FRUITS

- Apple
- Cherries
- ***Mango***
- Nashi fruit
- Pear
- Watermelon

VEGETABLES

- Asparagus
- Artichokes
- Sugar snap peas

OTHER

- Honey
- High Fructose Corn Syrup
- Frusana™

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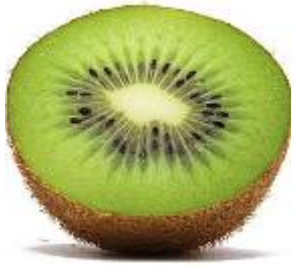
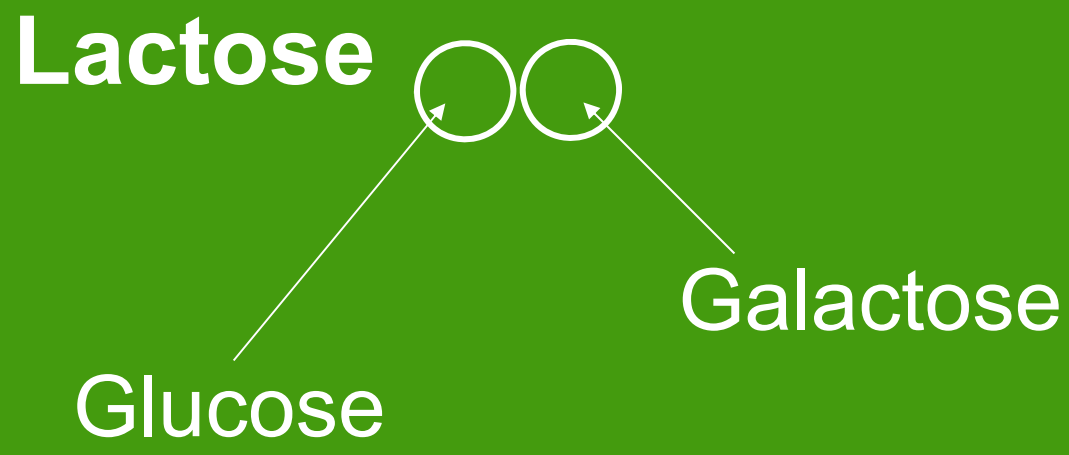


Lactose



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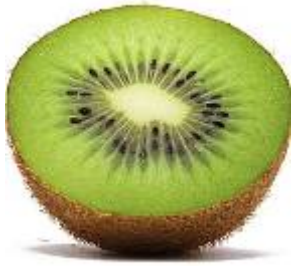

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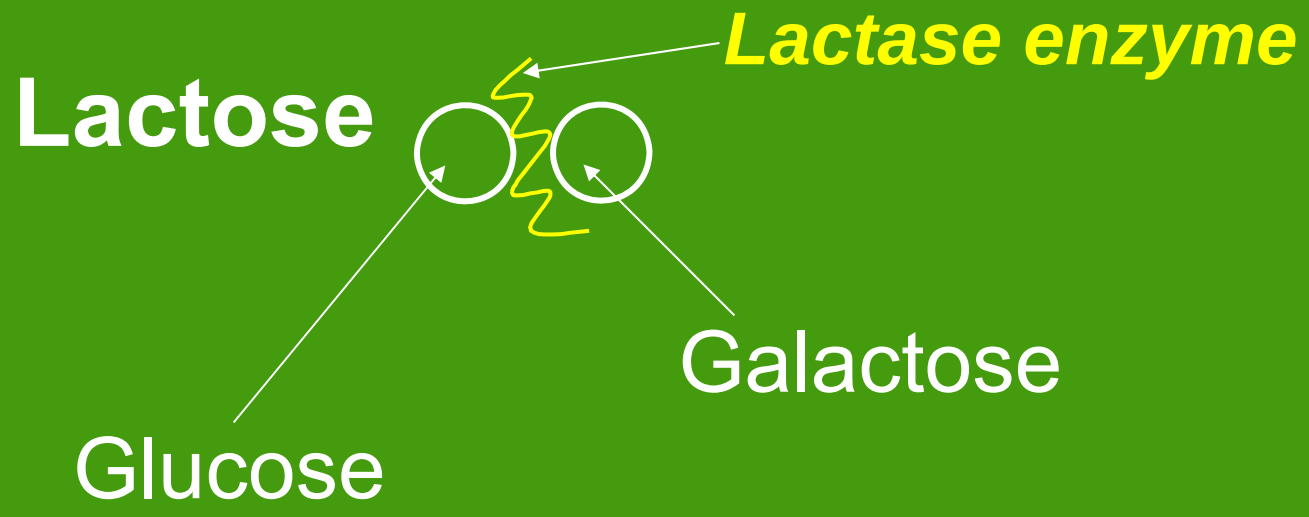

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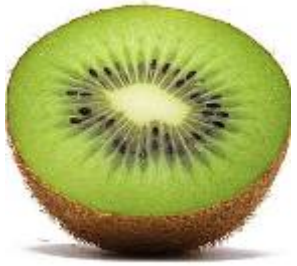

Lactose Malabsorption

- A condition of lactase deficiency
- Therefore lactose cannot be broken down

- so it remains as a double sugar

…. which is malabsorbed

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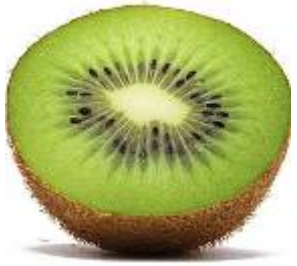

Lactose Malabsorption

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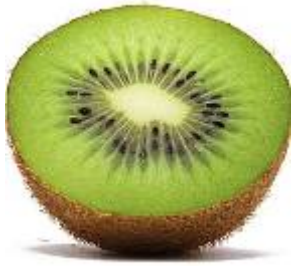
Only a FODMAP if lactase deficient



Foods with problem amounts of lactose

- Milk (Cow, Goat, Sheep) products
  - Milk
  - Yoghurt
  - Icecream
  - Custard
  - Soft cheeses

Suitable lactose-free alternatives

Milk

Yoghurt

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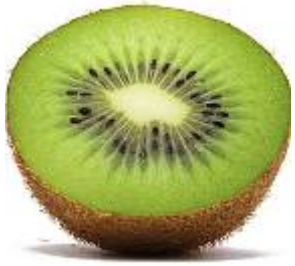

Lactose Malabsorption: Misconceptions

1. A lactose free diet is the same as a dairy free diet
   – WRONG! – Some foods are made from dairy and are lactose free
2. You must avoid every trace of lactose if you have lactose malabsorption
   – WRONG! - Small amounts of lactose-containing foods are often tolerated
     • Up to 4g per sitting (1 glass milk = 12-16g)

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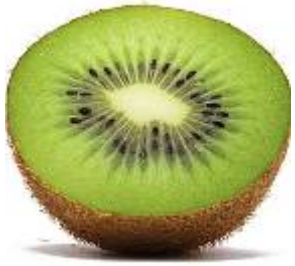

Suitable on a Lactose Free Diet

- Hard/Formed/Ripened Cheeses
  - eg. Parmesan, Cheddar, Edam, Gouda, Mozarella, Brie, Camembert
- Butter
- Milk used in small amounts as an ingredient in cakes, biscuits, or in small amounts used in tea and coffee

Lactase enzyme treatment is available

Lactase enzyme

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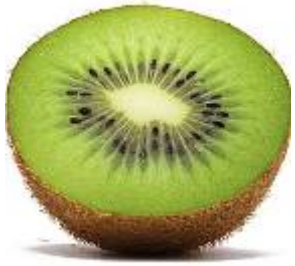
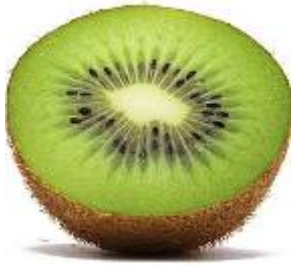


Polyols

P

- Sugar alcohols:
  - sorbitol, xylitol, mannitol, maltitol isomalt
- Poorly absorbed in the small intestine
  - passive absorption
    - Sorbitol 60% are malabsorbers
    - Mannitol 20% are malabsorbers



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"Excess consumption may have a laxative effect"

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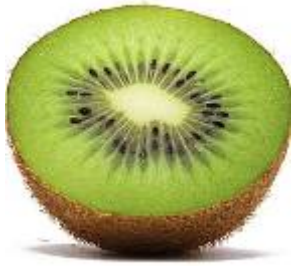

Foods with problem amounts of polyols

FRUIT

- Apple
- Apricot
- Avocado*
- Blackberries
- Cherries
- Longon*
- Lychee*
- Nashi Fruit
- Nectarine
- Pear
- Plum
- Prune

VEGETABLES

- Cauliflower
- Mushroom
- Snow peas

OTHERS

- Sorbitol
- Mannitol
- Maltitol
- Xylitol
- Isomalt

*problem if eaten in large quantities

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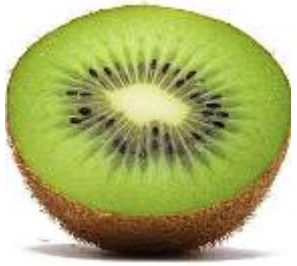
Fructans (fructo-oligosaccharides)

- Oligosaccharides of fructose units (ß1-2 bond) with a glucose terminal end

  - <10 units “fructo-oligosaccharide”
  - >10 units “inulin”
- The human SI does not produce a hydrolase capable of breaking the ß1-2 bond
  - >90% of dietary fructans arrive at the large bowel



Foods with problem amounts of fructans

FRUIT

- Peach
- Persimmon
- Rambutan*
- Watermelon

OTHER

- Inulin
- FOS
- Chicory drinks
- Legumes, lentils
- Chickpeas
- Pistachios

VEGETABLES

- Artichokes (Globe)
- Artichokes(Jerusalem)
- Beetroot*
- Brussels Sprouts
- Cabbage
- Chicory
- Dandelion leaves
- Fennel*
- Garlic
- Leek
- Okra
- Onion (brown, white, Spanish, onion powder)
- Peas*
- Shallot
- Spring onion (white part)

GRAINS

- Wheat*
- Rye*
- Barley*

*problem if eaten in large quantities

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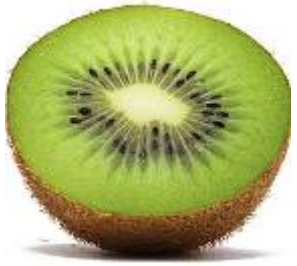

The wheat restriction explained on a low FODMAP diet

- The wheat restriction is not as strict as the gluten restriction required for coeliac disease. Many gluten free foods are suitable as they are wheat free.
- Also, the low FODMAP diet can be trialled to observe efficacy (unlike coeliac disease where a trial of a gluten free diet is not advocated).

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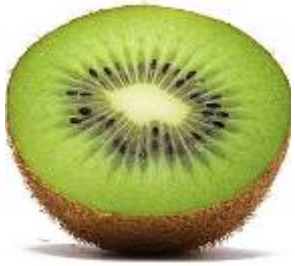

Galacto-oligosaccharides (GOS)

- Oligosaccharides with a β-fructosidic linkage and an α-galactosidic linkage
- Main dietary sources
  - Raffinose (1 F + 1G + 1 Gal)
  - Stachyose (1R + 1 Gal)

- Humans lack α-galactosidase
  - no hydrolysis of the galactosidic linkages to their monosaccharides

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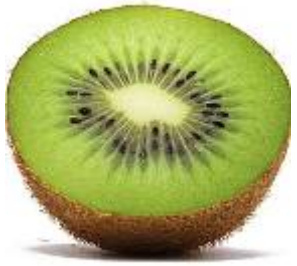
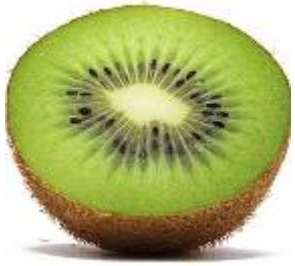


Foods with problem amounts of GOS

Found in:

- Legumes
  - eg. red kidney, baked, borlotti
- Chickpeas
- Lentils



So why don’t we all have IBS?

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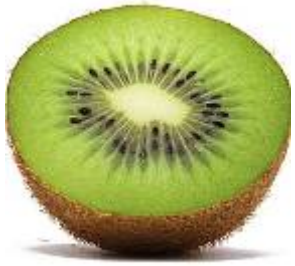

So why don't we all have IBS?

Remember

- None of us absorb Fructans (onion, wheat), or GOS (baked beans, lentils)
- Fructose Malabsorption is common
  - 30-40% of people with IBS
  - 30-40% of healthy controls

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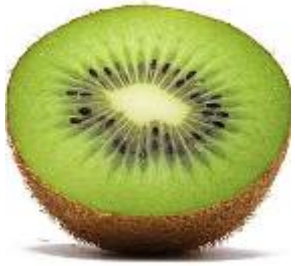

So why don't we all have IBS?

Remember

- None of us absorb Fructa…, wheat), or GOS (baked bea…
- Fructose M…
  - 30-4…
  - 30-40…

So if malabsorption of FODMAPs is common, why don't we all have IBS?

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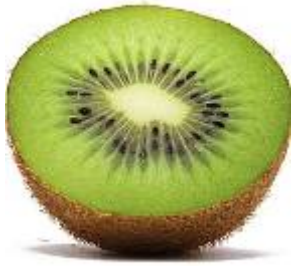

Why don’t we all have IBS?

Symptoms

Brain-gut axis

Enteric nervous system

Symptoms

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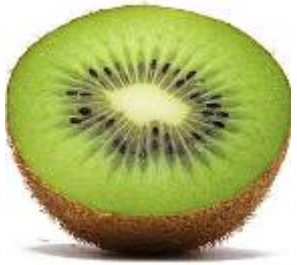
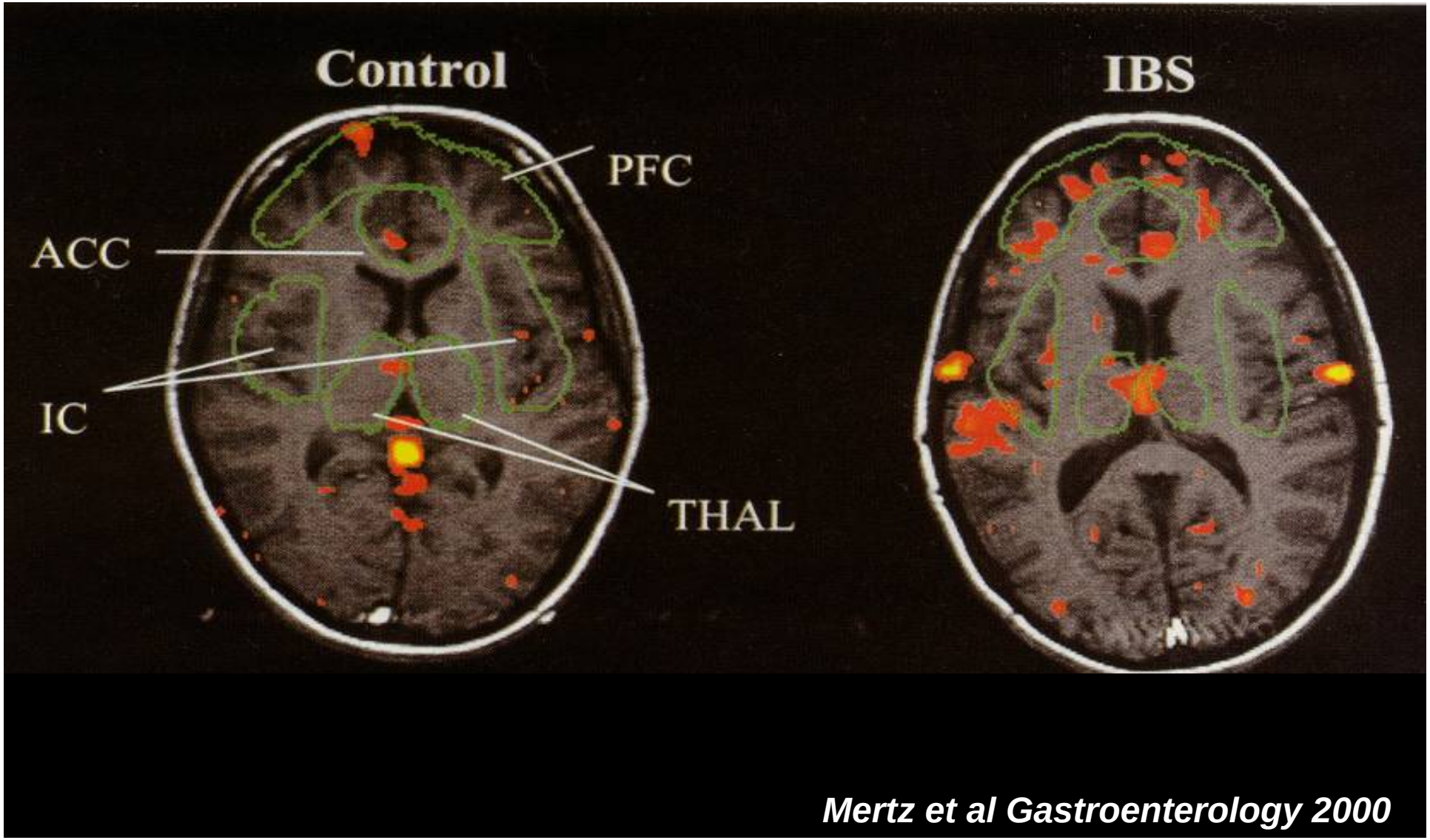
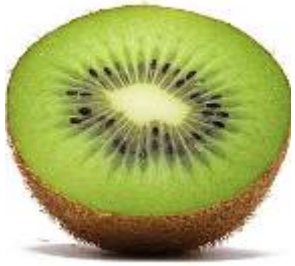


Functional MRI in response to rectal distension





When to treat?

- Treat the GI symptomatic patients only
  - eg. patients who have a rash but *no GI symptoms*, who have a positive breath test for fructose ***will not*** benefit from restricting fructose from their diet

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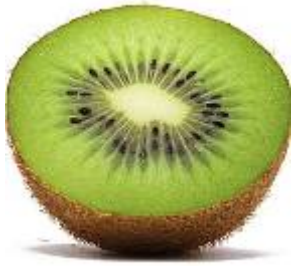

IMPLEMENTING THE LOW FODMAP DIET

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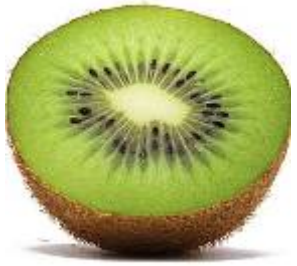

Keys aspects of FODMAP restriction

- Symptoms are due to **dose response**

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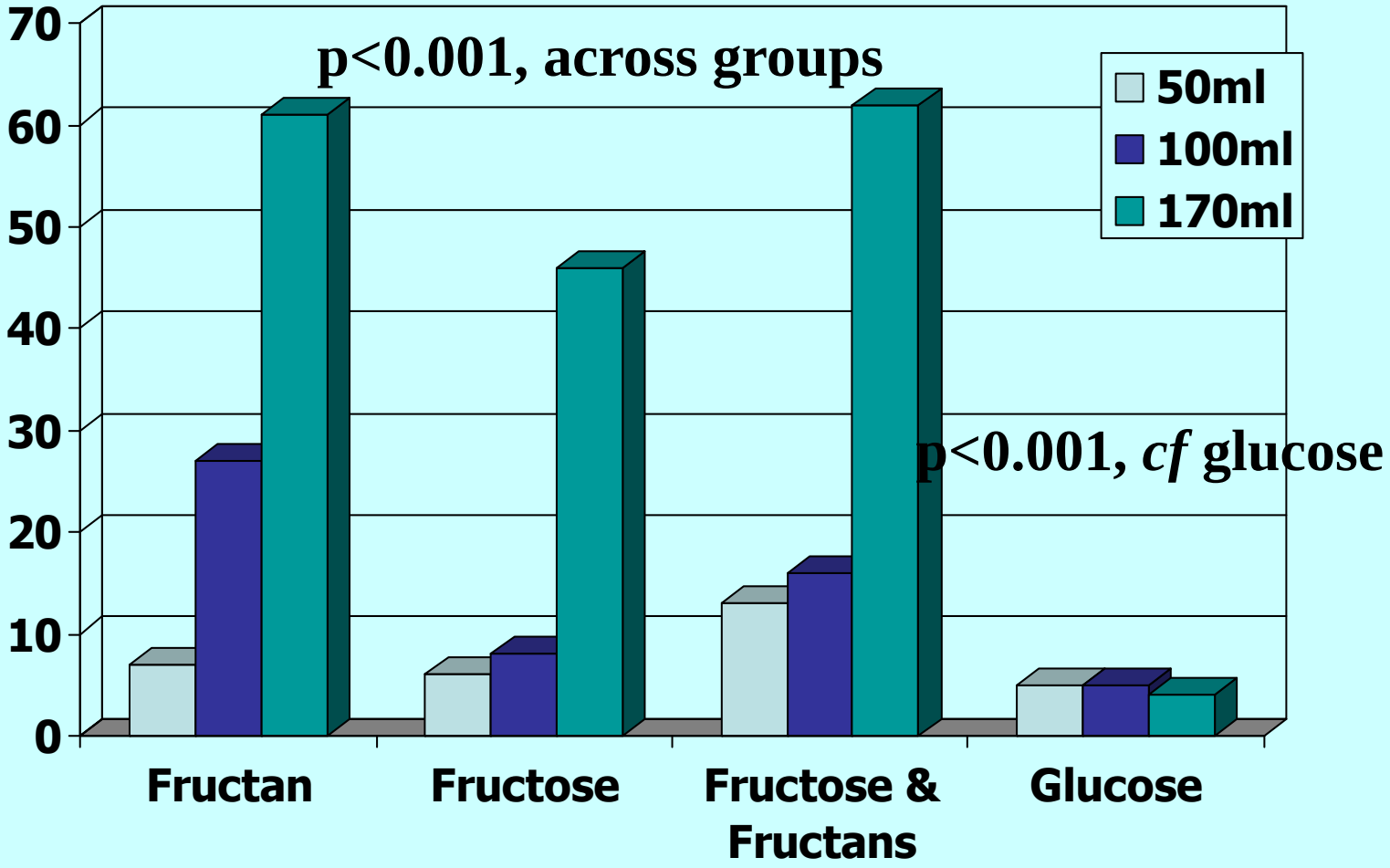
Median OVERALL Symptom score in relation to volume – effect of dose

*Median scores on VAS



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Shepherd, SJ et al, Clin Gast Hep 2008 Jul;6(7):765-71

Median OVERALL Symptom score in relation to volume – effect of dose

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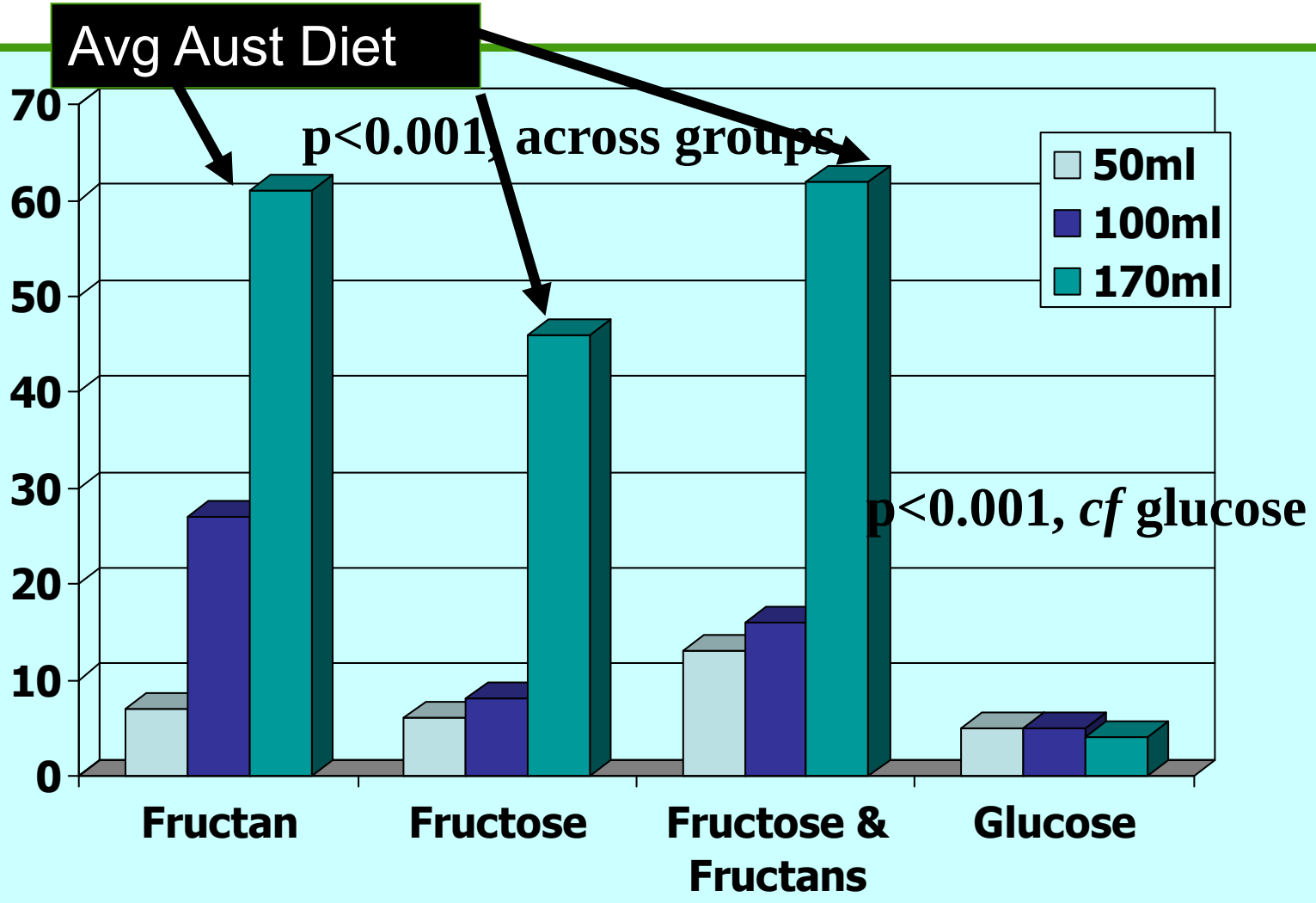

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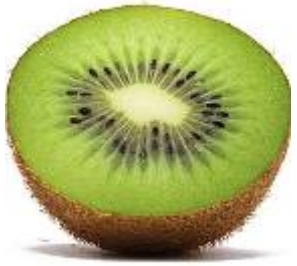
Shepherd, SJ et al, Clin Gast Hep 2008 Jul;6(7):765-71



Keys aspects of FODMAP restriction

- Symptoms are due to **dose response**
- All patients with IBS have different FODMAP tolerance levels

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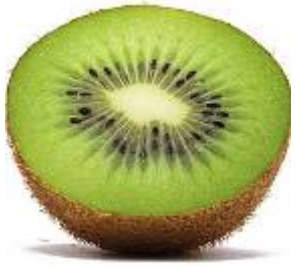

Best way to determine FODMAP tolerance

- Restrict known/suspected malabsorbed FODMAPs until adequate symptom control is achieved and maintained (approximately 6-8 weeks)
- Reintroduce foods in controlled amounts to best balance food restriction with symptoms

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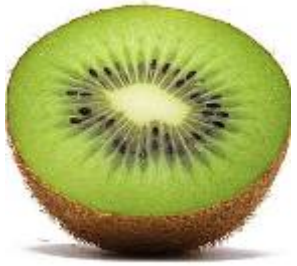

FINAL POINTS

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A low FODMAP Diet doesn't cure IBS

- Restricting FODMAPs is a proven effective way to control symptoms only
- Some patients will never get 100% symptom control
- There may be foods that always contribute to symptoms and require strict restriction
- Reminder that FODMAPs are good for bowel health, so absolute restriction is not encouraged.

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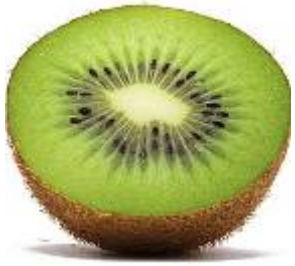

Non-Responsive Patient - Management

- Reassurance that food trials hasn't been a waste of time – they have assisted by ruling out what ISN'T the trigger
- Ensure all medical causes have been explored (should have been done already!)
- Consider alternative food triggers, trial reduction and monitoring symptoms
  - gluten (NCGI)*, food chemicals, food allergy, other

**Biesiekierski, et al 2011*

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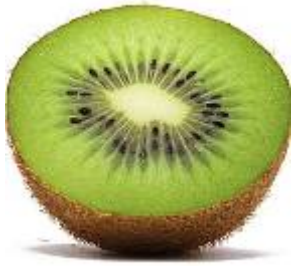
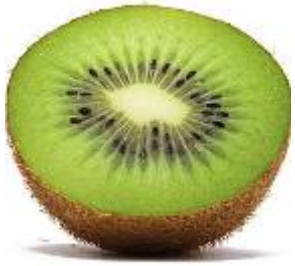


Non-Responsive Patient - Management

- Consider alternative (non-dietary) triggers, eg. stress and anxiety
- Patient should accept that they have IBS and diet is only one style of therapy. It is unlikely patient will always be symptom free



Conclusion

Goal of implementing low FODMAP diet for IBS relief is to *improve quality of life* (ie. reduce symptoms to patient's level of satisfaction) whilst still *including maximal variety* in the diet, in order to *maximise enjoyment* of food, and *minimise causing any other ill health* (eg. psychological distress due to food restriction)

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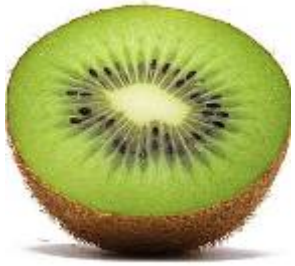

Practical Implications

- The low FODMAP diet is now accepted as the most efficacious dietary therapy for IBS
- Specialist dietitian education required
- Consider it in:
  - IBS
  - IBD: symptomatic in quiescent disease
  - Coeliac Disease: symptomatic despite compliance

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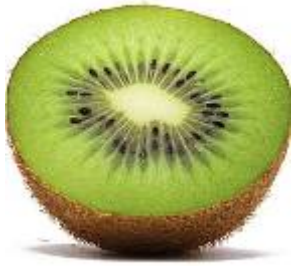
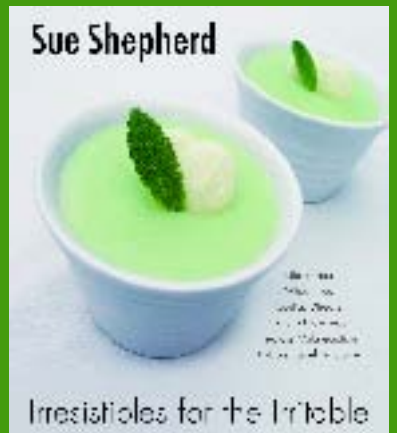
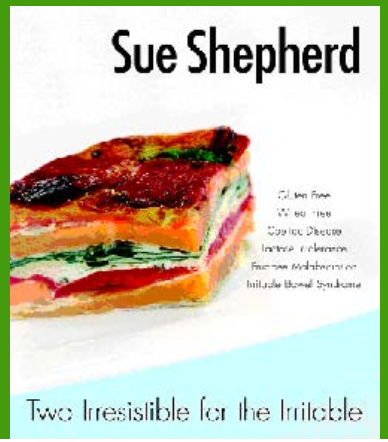


Further Information

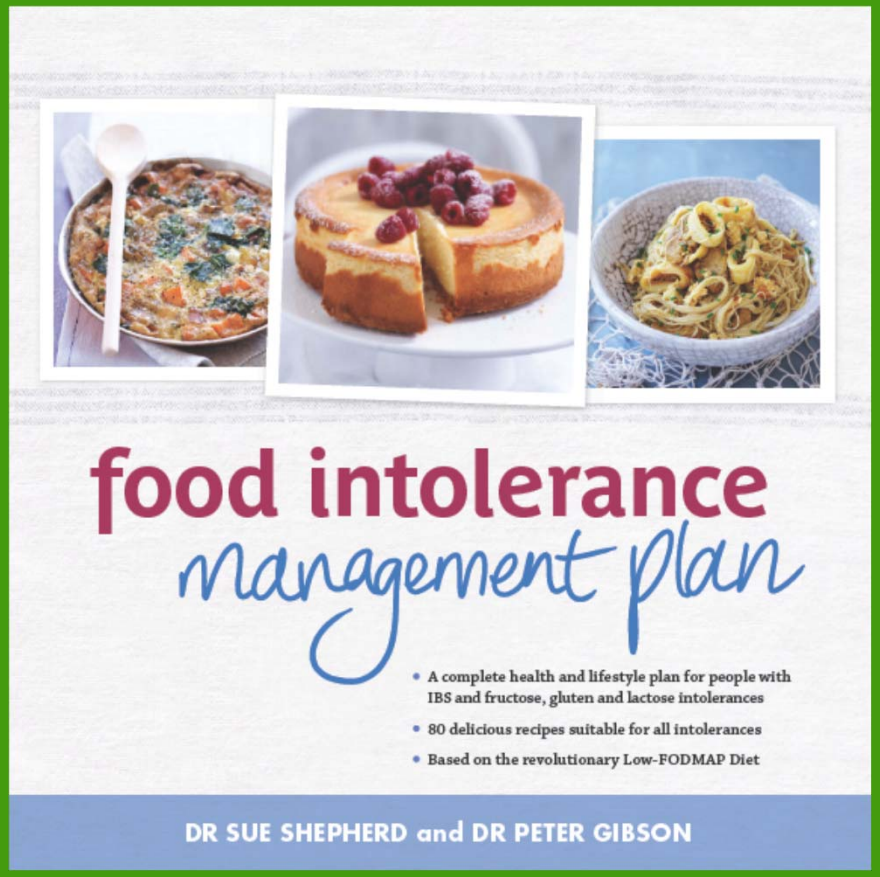
Cookbooks

www.shepherdworks.com.au





The Low FODMAP Diet: Resource book



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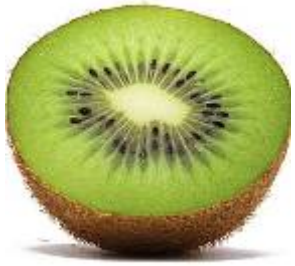

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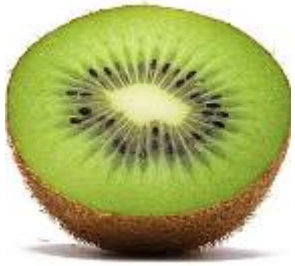

THANK YOU!

- For your warm welcome, hospitality and inviting me to meet with you!
- I have a gift for you……

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Suitable low FODMAP fruits

- Banana
- Blueberries
- Canteloupe
- Carambola (star fruit)
- Durian
- Grapes
- Grapefruit
- Honeydew melon
- Kiwi
- Lemon
- Lime
- Mandarin
- Orange
- Passionfruit
- Paw paw
- Pineapple
- Raspberry
- Rhubarb
- Strawberry
- Tangelo
- Avocado
- Longon
- Lychee
- Rambutan

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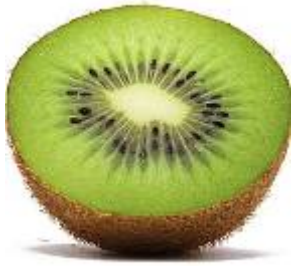

Suitable low FODMAP veg

- Alfalfa
- Bamboo Shoots
- Bean shoot
- Bean sprout
- Beans (green)
- Bok Choy
- Broccoli
- Capsicum
- Carrot
- Celery
- Chives
- Choy sum
- Corn
- Cucumber
- Endive
- Eggplant
- Ginger
- Lettuce
- Olives
- Parsnip
- Potato
- Pumpkin
- Silverbeet
- Spring onion (green part only)
- Spinach
- Squash
- Swede
- Sweet potato
- Tomato
- Turnip
- Zucchini
- Beetroot
- Fennel
- Peas

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