

**Yakult**

Science for Health



# Yakult Science Academy

A Guide for HCPs

[Find out more at yakult.co.uk/HCP](https://yakult.co.uk/HCP)

# Contents

**This practical guide aims to educate HCPs about the importance of a diverse diet to promote a more diverse gut microbiota**



Diet Diversity.....	1
Importance of Fibre.....	2
Prebiotics.....	5
Understanding plant points.....	6
Fermented Foods.....	8
Probiotics.....	9
References.....	10

## About Us

Yakult Science for Health is an educational hub for healthcare professionals to deepen their knowledge and understanding of the gut microbiota and probiotics.



## Visit our Yakult Science Learning Hub for access to:



Resources and e-learning



Yakult Science events



Microbiome Matters podcast with expert guests



Tailored workplace talks



Yakult Educational Grant



Research updates

This resource is intended for healthcare professionals and is not to be distributed to patients.

# Diet Diversity

Understand how 'diversity breeds diversity'

## Diversity Breeds Diversity

The gut microbiota adapts according to the foods we eat<sup>1</sup>. Consuming a diverse diet with a variety of plant sources results in consumption of more fibre. Fibre feeds the gut microbiota, increasing the number and types of beneficial bacteria (e.g., *Lactobacilli* and *Bifidobacteria*), thus creating more diversity. The groundbreaking 'American Gut Microbiome' study demonstrated that those who consumed >30 different type of plants per week had a more diverse gut microbiome compared to those who ate <10 different plants<sup>2</sup>.

## The Roles of the Gut Microbiota

The gut microbiota carries out a number of important key functions that support our health, with different microbes performing different roles<sup>3</sup>. A more diverse gut microbiota is more efficient at performing these tasks<sup>3</sup>:



### Communication

The gut microbiota communicates with major organs including the brain, skin, liver and lungs.



### Immunity

70-80% of our immune cells reside in the gut. Our gut microbiota trains and communicates with our immune cells.



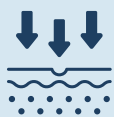
### Structural Integrity

The gut mucosal barrier strengthens protecting the gut from harmful pathogens.



### Protection

Secretion of antimicrobial substances to protect against harmful bacteria.



### Absorption & Synthesis

Absorption of nutrients including calcium, B vitamins, magnesium and iron, and synthesis of vitamins (e.g., K and B vitamins).



### Fermentation

Dietary fibres are fermented by the gut microbiota into short-chain fatty acids (SCFAs), which provide energy to gut cells.

# Fibre First

Understand dietary fibres and their importance in supporting the gut microbiota

## The Importance of Dietary Fibres

Diets high in fibre are associated with greater gut microbial diversity compared to diets low in fibre, and high in sugar, protein and fat<sup>4</sup>. Dietary fibres are carbohydrates which are not digested or absorbed in the small intestine<sup>5</sup>. In the large intestine, they are generally broken down by fermentation by the commensal gut microbiota to produce short-chain fatty acids (SCFAs), such as butyrate. SCFAs play a key role in metabolic health, weight management, and satiety<sup>5</sup>.



## Dietary Fibre and Disease Prevention



A systematic review and meta-analysis of 185 prospective studies and 58 clinical trials concluded that those consuming the recommended daily fibre intake (25-30g) had a decreased risk of mortality and incidence from the following diseases compared to those consuming a lower fibre intake:<sup>6</sup>

- **All-cause mortality:** 15%↓
- **Coronary heart disease mortality:** 31%↓
- **Stroke mortality:** 20%↓
- **Type 2 diabetes incidence:** 16%↓
- **Colorectal cancer incidence:** 16%↓
- **Cancer mortality:** 13%↓



It was found that more fibre is better: for every additional 8 grams of dietary fibre a person consumed, the risk for each of the diseases fell by another 5% to 27%<sup>6</sup>. Risk reductions were greatest with a daily fibre intake of 25-29g.

## Types of Dietary Fibre

A diverse diet consisting of different dietary fibres and resistant starches is more likely to support a more diverse microbial community<sup>2</sup>.

- 1 Soluble fibre:** Dissolves in water and is fermented into a gel-like substance in the colon by commensal bacteria.
- 2 Insoluble fibre:** Generally not fermentable and remains intact throughout the digestive tract. It acts by absorbing water and bulking stools.
- 3 Resistant starch:** Resistant to digestion, passing into the colon unchanged, and once there, it is fermented by commensal bacteria.

# Fibre Facts

Understand dietary fibre recommendations

## Dietary Fibre Recommendations

**Table 1.** UK and Ireland Daily Fibre Recommendations

Age Group	UK	Ireland
2-4 years	15g	Age + 5g
5-10 years	20g	Age + 5g
11-14 years	25g	Age + 5g
15-18 years	30g	Age + 5g
19+ years	30g	>25g

**Table 1** illustrates the daily fibre recommendations for the UK and Ireland. Average adult intakes in the UK and Ireland are 19g/day<sup>8,9</sup>.

## What Does 30g Fibre Look Like?

Here's an example of how you could consume 30g fibre in a day:



**1/2 cup rolled oats**  
(9g)



**100g raspberries**  
(5g)



**1/2 can baked beans**  
(8g)



**2 slices wholemeal bread**  
(4g)



**1 medium apple**  
(4g)

## Important Considerations when Increasing Fibre Intake



**Go low and slow:** Increase your fibre intake slowly. This is because the gut microbiota needs time to adapt to handle the new demand of fibre digestion. Over time, as fibre intake and diversity increases, the gut microbiota adapts to produce the hundreds of enzymes needed to break down the many different fibres and plant chemicals found in fibre-rich foods.<sup>7</sup>



**Hydration is key:** It is also important to increase hydration when increasing fibre intake. This is because fibre draws water into the bowel as it travels through the digestive tract.

# High Fibre Foods

Examples of fibre-rich food sources

## High Fibre Plant Foods

Here are some examples of fibre rich foods (per 100g):

### Fruits



Bananas  
1.4g



Strawberries  
3.8g



Plums  
2.3g

### Vegetables



Sweet Potato  
2.2g



Carrots  
3.9g



Broccoli  
2.8g

### Wholegrains



Wholegrain Bread  
7g



Wholewheat Pasta  
4.4g



Oats  
7.8g

### Nuts & Seeds



Almonds  
15.9g



Hazelnuts  
9.4g



Sunflower Seeds  
7.1g

### Legumes



Lentils  
3.8g



Chickpeas  
4.8g



Baked Beans  
4.9g

# Prebiotics

Deepen your understanding of prebiotics

## What are Prebiotics?

Prebiotics are ‘substrates that are selectively utilised by host microorganisms conferring a health benefit’<sup>10</sup>. Like dietary fibres, prebiotics are selectively fermented by beneficial bacteria into SCFAs and can increase bacterial growth (e.g., *Bifidobacteria*) leading to a more diverse microbiota<sup>11</sup>. However, microbiota changes following prebiotic consumption are specific to the individual<sup>12</sup>.

All prebiotics are dietary fibres, but not all dietary fibres are prebiotics

## Impact of Prebiotics on Health

### Healthy Digestion



Soften stool to make its passing easier<sup>13</sup>

### Calcium Absorption



Reduce intestinal pH which increases calcium solubility<sup>14</sup>

### Satiety



Stimulate hormone production allowing slowed gastric emptying and insulin release<sup>15</sup>

### Pathogen Defence



Prebiotic-induced SCFA production reduces intestinal pH, decreasing pathogen growth and colonisation<sup>16,17</sup>

## Prebiotic Recommendations

The most widely studied prebiotics occur naturally in foods (e.g., inulin, lactulose, galacto-oligosaccharides (GOS), and resistant starch)<sup>18</sup>. Prebiotics are commonly available in supplement form or as added ingredients. When recommending their use, it is important to specify the particular prebiotic (e.g., GOS) rather than the general term 'prebiotic'. In the UK, there are currently no dietary recommendations for prebiotics consumption. However, the International Scientific Association for Probiotics and Prebiotics (ISAPP) recommends a daily intake of at least 5g of prebiotics per day<sup>19</sup>. Dietary sources of prebiotics include:



Chicory



Leeks



Legumes



Jerusalem Artichoke



Bananas



Beans

### Only one prebiotic food health claim has been approved in the UK:

“Chicory inulin contributes to normal bowel function by increasing stool frequency”<sup>20</sup>. Therefore, any other foods containing prebiotic ingredients cannot be labelled a prebiotic with associated health benefits<sup>21</sup>. Instead, it should be labelled as ‘dietary fibre’.

# Plant Power

Get to know your plant points

## Understanding Plant Points

As a result of the landmark 'American Gut Microbiome' study, individuals are now encouraged to consume more 'plant points' with a recommended weekly goal of 30 plants. This is one way to increase diet diversity and increase daily fibre intake.

- 1 point = each type of plant (including different varieties of the same plant e.g., red and green bell peppers are one point each)
- 1/4 point = herbs, spices, tea, coffee and extra virgin oil

## The 6 Categories of Plant Points



Fruits



Vegetables



Legumes



Nuts & Seeds



Wholegrains



Herbs & Spices

## The Yakult Science 8 Plant Principles



### There's no harm in trying

Put a new plant in your shopping trolley every week



### Plant protein

Try plant protein sources (e.g., pulses, beans) instead of meat



### Heroes not sidekicks

Make plants the 'hero' of your meal not just a side dish



### Sprinkle on top

Herbs, spices, nuts and seeds contribute to your plant points



### Eat the rainbow

Focus on eating a range of colours to up your plant points



### Ready-to-go

Frozen, canned and dried plant sources also count



### Many-in-one

Swap solo sources for a mixture e.g., cous cous for mixed grains



### Inclusion not exclusion

Diet diversity is all about what you can add, not takeaway

For gut-loving plant-based recipes, visit the [Love Your Gut website](#)



# Fermented Foods

Diversify your diet with fermented foods

## Fermented Foods for a Diverse Microbiota

Rather than simply feeding our microbes with fibre, we can also ‘cheat’ by consuming live microbes in the form of fermented foods. Fermented foods and beverages are defined as “foods made through desired microbial growth and enzymatic conversions of foods components”<sup>22</sup>. Put simply, fermentation is a process in which live microorganisms break down food components (e.g., sugars) into other products (e.g., organic acids, alcohol, gas).



## Types of Fermented Foods

All foods and beverages produced by fermentation are considered fermented foods. However...



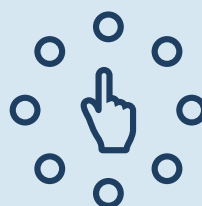
Not all fermented foods contain live microorganisms

This is due to the manufacturing processes used (e.g., heat-treated or pasteurised) which often remove the live microorganisms either to improve food safety or extend the product's shelf life<sup>19</sup>.

Fermented foods that <u>contain</u> live microorganisms (unless heat-treated/pasteurised)	Fermented foods that <u>do not contain</u> live microorganisms
<ul style="list-style-type: none"> <li>• Fermented dairy products (yoghurt, many cheeses, fermented milk drinks e.g., Yakult, kefir)</li> <li>• Fermented vegetables</li> <li>• Fermented soy products (miso, natto, tempeh)</li> <li>• Most kombuchas</li> <li>• Fermented cereals</li> <li>• Salami, pepperoni and other fermented sausages</li> <li>• Some beers</li> </ul>	<ul style="list-style-type: none"> <li>• Bread (including sourdough)</li> <li>• Wine, most beers and distilled spirits</li> <li>• Coffee and chocolate beans (after roasting)</li> <li>• Heat-treated and pasteurised equivalents of the examples in the left column</li> </ul>



Human studies show that microbes found in fermented foods can survive the gastric tract, reaching the large intestine alive, playing a part in the modulation of the gut microbiota.<sup>23-26</sup>



Different fermented foods provide different bacteria (i.e., lactic acid bacteria, acetic acid bacteria, yeasts, moulds) so encouraging variety is key.

# Ferment Findings

Understand the health effects of fermented foods



## Research Round-Up

Fermentation has shown to improve the availability of bioactive compounds (e.g., polyphenols) and remove toxins and antinutrients. This enhances the nutritive value of fermented foods and beverages.



## Foodie Findings



- **Fermented milk drinks:** Consumption of fermented milk products have shown to significantly decrease bloating and abdominal distension after 4 weeks<sup>27</sup>. Fermented milk drinks may also improve tolerance of plant-based diets and improved digestive wellbeing<sup>28</sup>.
- **Kefir:** Some studies suggest that kefir may lead to short-term improvements in the quality of life of patients with inflammatory bowel disease (IBD)<sup>29</sup>.
- **Natto:** There is evidence to suggest that natto can improve bowel habits in patients with mild constipation<sup>30</sup>.
- **Sauerkraut:** In a pilot study, sauerkraut was shown to improve the symptom severity score in patients with irritable bowel syndrome (IBS)<sup>31</sup>.
- **Sourdough bread:** A study reported that sourdough baked goods significantly reduced gastric volume, hydrogen production and post-prandial gastrointestinal symptoms compared to brewer's yeast baked goods<sup>32</sup>.

### Only one fermented food health claim has been approved in the UK

“Live cultures in yoghurt or fermented milk improve lactose digestion of the product in individuals who have difficulty digesting lactose”<sup>19</sup>.





# Probiotics

Understand probiotics

## The Difference Between Probiotics and Fermented Foods

Probiotics are defined as “live microorganisms which, when administered in adequate amounts, confer a health benefit on the host”<sup>33</sup>. Fermented foods and beverages often do not meet the requirements of a probiotic because:

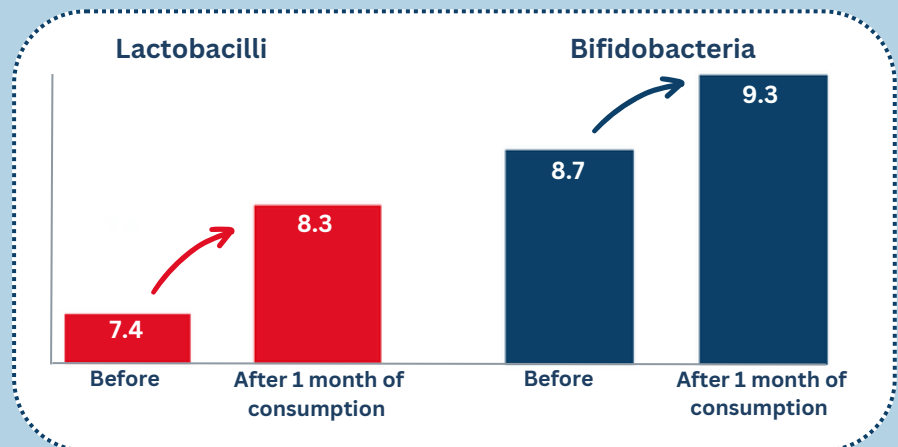
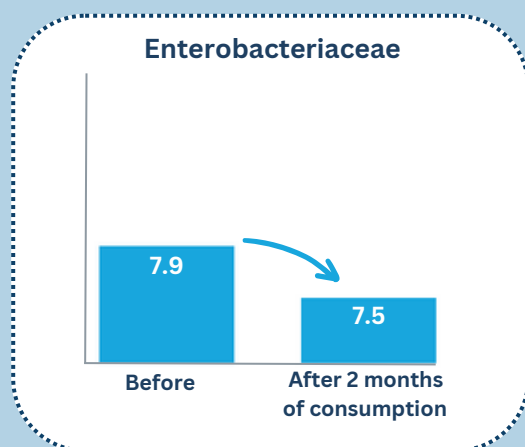
-  They generally contain undefined microbial strains, in variable amounts and/or...
-  Their potential health benefits have not been demonstrated in well-controlled intervention studies.<sup>34</sup>



Fermented foods/beverages can be considered “probiotic fermented foods” if there is evidence from intervention studies proving they contain a specific microbial strain(s) in adequate amounts.

## Probiotics & Gut Microbiota Diversity

Probiotics can be deemed as ‘superior’ to fermented foods as probiotics have been shown to increase gut microbiota diversity by introducing beneficial bacteria to the gut which is known to survive the gastrointestinal tract<sup>35</sup>. For example, *Lactocaseibacillus paracasei* Shirota (LcS - the unique bacteria in Yakult) has been shown to increase bifidobacteria and lactobacilli in the gut microbiota after 4 weeks of daily consumption<sup>35</sup>. LcS consumption has also been shown to decrease the number of potentially harmful bacteria in the gut<sup>36</sup>. For example, *Clostridium difficile*, *Clostridium perfringens*, *Enterobacteriaceae*, *Staphylococcus* and *Pseudomonas*.



\*Data presented as the mean values (log<sub>10</sub> cells) per gram of faeces<sup>35</sup>

# References

Authors: Charlotte Phillips and Dr. Emily Prpa, Yakult UK & Ireland  
Reviewers: Professor Bruno Pot and Dr. Nikoletta Vidra, Yakult Europe

1. De Angelis et al. (2019) *Cur Med Chem* 26(19): 3567-83
2. McDonald et al. (2018) *MSystems* 3(33): 10-128
3. Thursby et al. (2017) *Biochem J* 474(11): 1823-26
4. De Filippo et al. (2010) *PNAS* 107(33): 14691 – 14696
5. Koc at al. (2020) *Nutrition Bulletin* 45: 294-308
6. Reynolds et al. (2019) *The Lancet*, 393(10170): 434-445.
7. Ioniță-Mîndrican et al. (2022) *Nutrients*, 14(13), p.2641.
8. Public Health England (2020) NDNS: results from years 9 to 11 (combined) – statistical summary
9. National Adult Nutrition Survey (2008-2010) NANS: Summary Report March 2011
10. Gibson et al. (2017) *Nat Rev Gastroenterol Hepatol* 14:491–502
11. Ruberfroid et al. (2010) *Br J Nutr* 104(S2):S1-63.
12. Davis et al. (2011) *PLoS ONE* 6(9):e25200.
13. Naseer et al. (2020) *Curr Clin Pharmacol* doi: 10.2174/15748847156662002 12125035. 10.
14. Whisner et al. (2013) *Br J Nutr* 110(7):1292-1303. 11.
15. Byrne et al. (2015) *Intl J Obes* 39(9):1331–1338. 12.
16. Walker et al. (2005) *Appl Environ Microbiol* 71(7):3692-3700. 14.
17. Moro et al. (2006) *Arch Dis Child* 91(10):814-9. 15. Arslanoglu et al. (2012) *J Biol Regul Homeost Agents* 26(3):46-59.
18. Slavin (2013) *Nutrients* 5(4):1417-35
19. ISAPP (2017) Prebiotics. Available at: [http://4cau4jsaler1zglkq3wnmje1-wpengine.netdna-ssl.com/wp-content/uploads/2019/04/Prebiotics\\_Infographic\\_rev1029.pdf](http://4cau4jsaler1zglkq3wnmje1-wpengine.netdna-ssl.com/wp-content/uploads/2019/04/Prebiotics_Infographic_rev1029.pdf) (Accessed: November 2020).
20. EFSA NDA Panel (EFSA Panel on Dietetic Products, Nutrition and Allergies). Scientific Opinion on the substantiation of a health claim related to “native chicory inulin” and maintenance of normal defecation by increasing stool frequency pursuant to Article 13.5 of Regulation (EC) No 1924/2006. EFSA
21. Declour et al. (2016) *Adv Nutr* 7(1):1-4.
22. Marco et al. (2021) *Nat Rev Gastroenterol Hepatol* 18:196-208
23. Oozer et al. (2006) *Appl Environ Microbiol* 72 : 5615-5617
24. Tuohy et al. (2006) *J Appl Microbiol* 102(4): 1026-1032
25. Milani et al. (2019) *Nat Commun* 10(1) : 1286
26. Taylor et al. (2020) *mSystems* 5(2) : e(00901-19)
27. Agrawal et al.(2009) *Aliment Pharmacol Ther* 29(1): 104-14
28. Le Neve et al. (2021) *Nutrients* 13(12): 4542
29. Yilmaz et al. (2019) *Turk J Gastroenterol* 30(3): 242-253
30. Mitsui et al. (2006) *Jpn Pharmacol Ther* 34(1) : 135-148
31. Nielsen et al. (2018) *Food Funct* 9: 5323-5335
32. Polese et al. (2018) *Jl Nutr* 148(2): 202-208
33. Hill et al. (2014) *Nat Rev Gastroenterol Hepatol* 11(8): 506-514
34. Marco et al. (2021) *Nat Rev Gastroenterol Hepatol* 18:196–208
35. Nagata et al. (2011). *Br J Nutr* 106(4): 549-556
36. Nagata et al. (2016) *Ann Nutr Metab* 68(1):51–59

Published October 2023