### Module 3: Dietary fibre and health

#### **Objectives**

This module will help you understand the role of fibre in:

- Digestive health.
- Reducing risk of heart disease, type 2 diabetes and obesity.
- The gut microbiome.





### Fibre and health: An overview

- Adequate intake of fibre is important for digestive and gut health including reducing risk of colorectal (bowel) cancer.
- Dietary fibre can also reduce the risk of:
  - Cardiovascular disease (heart disease and stroke)
  - Type 2 diabetes









The association of fibre and lowering the risk of certain diseases does not indicate that claims are allowed relating to these. Authorized claims vary by country/region.



### Risk of diets low in fibre

• Poor fibre intake is a risk factor for ill health.

- The 2017 Global Burden of Disease (GBD) study estimated that in European Union countries diets low in fibre accounted for approximately 97 000 deaths from all causes and more than 1 440 000 Disability Adjusted Life Years (DALYs), mainly caused by heart disease and colorectal cancer.
- In the GBD study, low in fibre is defined as average consumption of less than 23.5 grams per day of fibre from all sources including fruits, vegetables, grains, legumes and pulses.



Mortality map: deaths/100 000 attributable to diet low in fibre in EU Member States

Source: GBD Results Tool

http://ghdx.healthdata.org/gbd-results-tool?params=gbg-api-2017-permalink/045c4276f163ff5df0b6f485da017d26

### Fibre and digestive health

#### DID YOU KNOW YOUR GUTS ARE ABOUT 25FT (7-8M) LONG?!

- Dietary fibre can help digestion.
- Eating a diet low in fibre is associated with:
  - Constipation;
  - Diverticulitis

     (where the bowel wall becomes inflamed and ultimately damaged);
  - Bowel (colorectal cancer) cancer.

#### Constipation

- Constipation is the difficulty or infrequency in opening the bowels, and/or seemingly incomplete bowel emptying.
- The Rome IV diagnostic criteria for chronic constipation include spontaneous bowel movements occurring less than three times a week but in reality, constipation is often defined as passage of stools less frequently than the person's normal pattern.

#### **Constipation is common**

- Constipation is a common condition affecting people of all ages.
- Global prevalence of functional constipation in adults has been estimated to be between ~10-15%. In adults it tends to be more common in women, older adults, and during pregnancy.
- It's estimated that around up to 1 in 3 children and 1 in 7 adults in the UK has constipation at any one time.
- In 2018-19, 76,929 people were admitted to hospital in England with constipation, which cost £168 million to treat.



# Constipation: Risk factors and management

- Constipation can be caused by dietary and lifestyle factors such as a low intake of fibre, not drinking enough fluids, stress, being sedentary or side effects of medicines. But sometimes there is no obvious reason for constipation.
- Constipation can usually be treated with simple diet and lifestyle changes.

Lifestyle change	Current UK Recommendation*
Increase fibre intakes	~ 30 g/day
Drink plenty of fluids	6-8 glasses of fluid/day
Be physically active	At least 150 min of moderate intensity activity or 75 min of vigorous intensity activity/week

How does fibre
help prevent constipation?
In general, the greater the weight of the stool and the more rapid the rate of passage through the colon the better the laxative effect.

- Dietary fibre helps draw water into the stool to soften it and improve stool consistency, it can increase faecal weight or bulk and can speed up transit time which improves bowel movement consistency.
- For fibre to have the best effect on preventing constipation, an increase in fibre intake should be accompanied by an increase in fluid intake.



\* Recommendations to increase fibre, fluid intake and physical activity for constipation management, similarly exist in other regions.

### Colorectal (bowel) cancer

Bowel cancer is a general term for cancer that begins in the large bowel. Depending on where the cancer starts, bowel cancer is sometimes called colon or rectal cancer.

#### What's the prevalence?

Colorectal cancer is the third most common cancer worldwide

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Rank	Country	Age standardised rate/ 100,000	(
1	Hungary	51.2	
2	South Korea	44.5	
3	Slovakia	43.8	
4	Norway	42.9	
5	Slovenia	41.1	
6	Denmark	41.0	
7	Portugal	40.0	
=8	Barbados	38.9	
=8	Japan	38.9	
10	Netherlands	37.8	
11	Australia	36.9	
12	Singapore	36.8	
13	Serbia	36.7	
=14	Belgium	35.3	
=14	New Zealand	35.3	
=16	Uruguay	35.0	
=16	Brunei	35.0	
18	Moldova	34.2	
19	Croatia	34.1	
20	Ireland	34.0	
21	Spain	33.4	
22	Latvia	33.0	
23	Czech Republic	32.7	
24	UK	32.1	
25	Belarus	31.8	

Global colorectal cancer burden 2018

#### Top 25 countries

Adapted from WCRF. Colorectal cancer statistics <u>https://www.wcrf.org/dietand</u> <u>cancer/colorectal-cancerstatistics/</u>

### Colorectal cancer: Risk factors

Risk factors for colorectal/bowel cancer include:

- Age
- Genetics
- Overweight and obesity
- Unhealthy diet (e.g. low fibre and high intake of red and processed meat)
- Lifestyle factors (e.g. low physical activity levels and smoking).

The World Cancer Research Fund (WCRF) estimates that 45% of bowel cancer could be prevented through diet, physical activity and weight



Suggested mechanisms for risk reduction: Fibre & Wholegrains

Fibre	Wholegrains
Promotes beneficial gut microbiota*	May bind to carcinogens.
Produces short-chain fatty acids in the large bowl which may have anti-carcinogenic properties	Contain bioactive nutrients, non-nutrient compounds and dietary fibre which may have anti-carcinogenic properties
Reduces transit time and increases faecal bulk, which would lessen the contact for potential faecal carcinogens** to initiate in the colon	

- \*The gut microbiota : The human body's largest population of microorganisms resides in the intestine and is collectively called the gut microbiota
- \*\*A carcinogen is a natural or man made agent with the capacity to cause cancer in humans and work by interacting with a cell's DNA and inducing genetic mutations.



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### Cardiovascular disease (CVD)

- CVD is a general term for conditions affecting the heart or blood vessels.
- It includes conditions such as coronary heart disease, heart failure, stroke and vascular dementia.

#### What's the prevalence?

 CVD is the leading cause of death globally, with an estimated 17.9 million lives each year.



CVD is usually associated with a build-up of fatty deposits inside the arteries (atherosclerosis) and an increased risk of blood clots.



### Cardiovascular disease (CVD) : Risk factors

Over 70% of CVD is caused by modifiable risk factors.

#### **Risk factors for CVD include:**

- High cholesterol
- High blood pressure
- Smoking
- Low physical activity levels
- Overweight and obesity
- Unhealthy diet (e.g. low fibre intakes)
- Excessive alcohol consumption

A high fibre diet, as part of a healthy diet and lifestyle, is associated with a lower risk of CVD.

#### **Beta glucan fibre**

- Foods such as oats and barley contain a type of fibre known as beta glucan, which may help to reduce cholesterol levels if 3g or more are consumed daily, as part of a healthy diet.
- When beta glucan is consumed, it forms a gel which binds to cholesterol-rich bile acids in the intestines. This helps limit the amount of cholesterol that is absorbed from the gut into the blood. The liver then has to take more cholesterol out of the blood to make more bile, which lowers blood cholesterol.
- Elevated blood cholesterol is a recognised risk factor for CVD.

Cardiovascular disease covers all diseases involving the heart and circulation. These include coronary heart disease, heart attack, heart failure and stroke.

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#### Weight management

- Living with obesity increases the risk of chronic conditions such as cardiovascular disease, type 2 diabetes, and some cancers. It is also associated with increased risk of mental health issues like depression and low self-esteem.
- Overall, about 13% of the world's • adult population (11% of men and 15% of women) and about 6% of girls and 8% of boys were obese in 2016.



	South Africa	26.2
	WHO Eastern Mediterr	anean Region
	Iran	22.7
	United Arab Emirates	27.8
	Saudi Arabia	28.1
	Iraq	33.5
	Egypt	35.7
	Kuwait	43.8
	WHO EU Region & UK	
	Italy	10.8
	Austria	12.0
	Spain	14.1
	France	15.4
	Portugal	15.7
	Germany	16.9
	Ireland	18.7
	Hungary	20.0
	Belgium	21.2
	Wales	25.1
	Malta	25.7
	Czech Republic	26.9
	England	28.0
	Scotland	29.0
	Greece	32.1
	WHO Americas Region	
	Brazil	20.7
	Canada	26.9
	Argentina	32.4
	Chile	34.4
	Mexico	36.1
Source:	US	42.7
World Obesity Federation 2020	WHO SE Asia Region	
https://data.worldobesity.org/tables/prevalence-of-	India	4.1
adult-overweight-obesity-	Indonesia	5.6
2/?regionid=1&msr=msr&breakdown=c;	Thailand	9.0

Country

Zambia

Kenva Algeria

Ghana

WHO Africa Region

% of adult obesity

7.5

8.9

19.5 21.1

### Risk factors: Obesity

- At a very basic level, obesity is caused by consuming more calories (energy), than the body uses.
- But it is recognised that obesity is a complex condition and it may be challenging to lose weight in an obesogenic environment with easy availability and accessibility of energy-dense foods, along with promotion of these.

## Fibre and weight management

Fibre may increase feelings of fullness and decrease energy intake:

- Some types of fibres (e.g. fibres in oats and fruit) can form a thick gel in the stomach. This gel may slow down gastric emptying.
- Bulk provided by some fibres (e.g. wholegrains) may also increase stomach distention.
- The WHO's systematic review and metaanalysis on *Carbohydrate quality and human health* found that in clinical trials, higher intakes compared to lower intakes of dietary fibre was shown to significantly reduce bodyweight.
- Alongside other dietary strategies increasing fibre intake may help with weight management.



### Type 2 diabetes (T2D)

- T2D is a condition where blood glucose becomes too high, because the pancreas doesn't produce enough insulin and/or the insulin that is produced does not work correctly.
- In 2017, it was estimated that 6% of the population globally were affected by type 2 diabetes.



Disease burden of type 2 diabetes, 2017

12000

10000



Prevalence (cases per 100,000) Burden of suffering (DALY per 100,000)

Khan MAB et al. (2020) J Epidemiol Glob Health.



#### Risk factors: type 2 diabetes (T2D) Overweight and

T2D is strongly linked with overweight and obesity.

Other risk factors include:

- Family history
- Ethnicity
- History of gestational diabetes
- Diet

obesity have been estimated to account for about 65–80% of new cases of type 2 diabetes (WHO Europe).

People from Black African, African Caribbean and South Asian backgrounds are 2– 4 times more likely to develop T2D than the white population.

Eating a healthy varied diet, being physically active and losing weight can help to reduce the risk of developing T2D.

#### Fibre and reduction of risk

Dietary fibre has been shown to improve glycaemic control and has an important role in managing T2D.

- Dietary fibres that have been shown to reduce the rise in postprandial (after meal) blood glucose and have EU approved health claims include:
  - **Resistant starch,** a form of starch that cannot be digested in the small intestine
  - Pectins, a polysaccharide present in plant cell walls
  - Beta-glucans, a fibre type found in oats or barley
  - Arabinoxylan, a fibre type found in wheat and rye (wholegrain varieties of foods contain higher amounts)

Natural sources of these fibres can be found in fruits, wholegrains and wholegrain products, pulses and beans.

## What do authoritative bodies say about fibre and health?



"Overall, prospective cohort studies provide mainly adequate evidence that a diet higher in dietary fibre is associated with a lower incidence of cardiovascular diseases, coronary events, type 2 diabetes mellitus, colorectal cancer, colon and rectal cancer. Randomised controlled trials indicate no effect of dietary fibre on cardio-metabolic risk factors, except for relatively high doses of β-glucan fibre, but do indicate a beneficial effect of dietary fibre on constipation, on decreasing intestinal transit times and on increasing faecal mass."





Australian Government Department of Health and Ageing

> National Health and Medical Research Council



MANATŪ HAUORA

"The complementary findings from prospective studies and clinical trials, which show that higher intakes of dietary fibre or whole grains are associated with a reduction in the risk of mortality and incidence of a wide range of non-communicable diseases and their risk factors, provide convincing evidence for nutrition recommendations to replace refined grains with whole grains and increase dietary fibre to at least 25–29 g per day, with additional benefits likely to accrue with greater intakes."





### The gut microbiome: the emerging evidence

- Evidence suggests the gut microbiota (microorganisms that live in the human digestive system) appear to be involved in many aspects of human health including immune, metabolic and neuro-behavioural functions.
- Diet has been shown to play a role in shaping the microbiome.
- Healthier dietary patterns [e.g. plant based vs animal based diets, Mediterranean diet; Healthy Eating Index (diets compliant with the U.S. Dietary Guidelines for Americans) typically demonstrate a more favourable pattern of bacterial clusters.]



### The gut microbiome and fibre

- Dietary fibre can promote healthy gut microbiota composition.
- High intake of non-digestible fibre is associated with greater abundance of 'healthy' bacteria such as bifidobacteria and lactic acid bacteria, and the associated production of short-chain fatty acids (SCFAs), which may have important functions in both gut health and overall health.



Factors likely to be involved in the impact of dietary fibre intake upon gut microbiota composition in humans.



### Specific fibres and the gut microbiome

 Intervention studies have shown that different fibre types may increase levels of specific strains of beneficial gut microbiota, decrease levels of pathogenic bacterial populations and increase short chain fatty acid (SCFA) production.

Fibre types	Potential impact on gut microbiota
Resistant starch (RS)	<ul> <li>increase certain bacterial groups associated with butyrate production (e.g. Bifidobacterium adolescentis, R. bromii, E.Rectale)</li> <li>increase in total SCFA levels</li> </ul>
Fibres in wholegrains	<ul> <li>wheat fibre may increase levels of Lactobacillus</li> <li>wheat &amp; corn fibre may increase the levels of Bifidobacterium</li> <li>barley fibre may increase the levels of Firmicutes</li> </ul>
Prebiotics	<ul> <li>increase in Bifidobacteria &amp; Lactobacilli</li> <li>decrease in pathogenic bacteria populations</li> </ul>

#### When may high fibre diets not be appropriate?

- For the general population, a higher fibre diet is recommended.
- However there may be a need for a low fibre diet in certain clinical conditions e.g. when people need to avoid foods that may irritate an inflamed bowel or when obstruction narrows parts of the bowel.
- A low or lower fibre diet may be recommended for management:
  - If there is a flare-up of a digestive illness, such as Crohn's disease, ulcerative colitis or with certain irritable bowel syndrome symptoms.
  - To ease the passage of stools through the bowel when there is an obstruction or stricture.
- The amount of dietary fibre may need to be adjusted, and a healthcare professional should advise on the right amount for the individual.



### Key learning points

- A diet high in fibre is important for digestive and gut health and can prevent constipation.
- A diet high in fibre can help reduce the risk of chronic diseases such as cardiovascular disease (heart disease and stroke), type 2 diabetes, and colorectal cancer (bowel cancer), but the association of fibre and lowering the risk of certain diseases does not indicate that claims are allowed relating to these. Authorized claims vary by country/region.
- Cardiovascular disease, type 2 diabetes and bowel cancer are major global public health problems. Risk of these diseases can be lowered by some lifestyle factors such as a higher fibre, balanced diet. For this reason, encouraging healthier diets will bring huge social and economic benefits.
- Research indicates health benefits are associated with the consumption of total fibre from the different fibre types present in a healthy, balanced and varied diet.
- Emerging research suggests that a healthier dietary pattern may promote a healthy gut microbiome, and that this may play a role in our immunity and metabolic health.
- Intervention studies on specific dietary fibres have also shown them to influence the abundance of certain strains of beneficial gut microbiota, but how this translates into health outcomes is not yet clear.
- A higher fibre diet is recommended for the vast majority of the population. However, a low fibre diet may be advised for management in certain clinical conditions such as flare-ups of Crohn's disease, ulcerative colitie, or irritable bowel syndrome.

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#### **Constipation**

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- BDA <u>– Feeling bunged up? Don't let poo be a taboo</u>
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