# THE HEALTH BENEFITS OF APPLES
## A report by Juliette Kellow RD commissioned by Pink Lady® UK

## PART 1 SETTING THE SCENE

### INTRODUCTION

The state of the nation's health and what we should – and shouldn't – be eating to stay healthy and live longer is rarely out of the news. It's unsurprising considering so many of the diseases that are commonly seen in the Western world are linked to a poor diet. What we eat is known to influence our risk of developing many major health problems, including obesity, heart disease, type 2 diabetes, high blood pressure, stroke, many cancers and dementia. In fact, scientists have estimated that 11 million deaths around the world are related to a poor diet – that's more than a fifth (22 percent) of all adult deaths[1].

So just what should we be eating to stay healthy? The message from health organisations around the world, including the World Health Organization, is consistent and really very simple: we should all be aiming to eat a more plant-based diet. That's not to say we need to become vegetarian or vegan. Most health organisations agree there's no need to give up meat, fish, eggs or dairy completely. However, plants should take centre stage on our plates and provide most of our nutrition[2].

This, of course, isn't just better for our health. Numerous studies suggest it's also better for the planet. This was summed up in a report published in The Lancet in early 2019[3]. Compiled by 37 scientists from 16 countries around the world, the recommended diet – hailed as the 'planet diet'– is projected to prevent around 11 million premature deaths each year by promoting a healthier, mainly plant-based, diet. At the same time, the scientists say this way of eating will help protect the planet from undesirable environmental effects such as excessive greenhouse gases, over-usage of water and wildlife destruction – all things associated with farming, particularly of livestock.

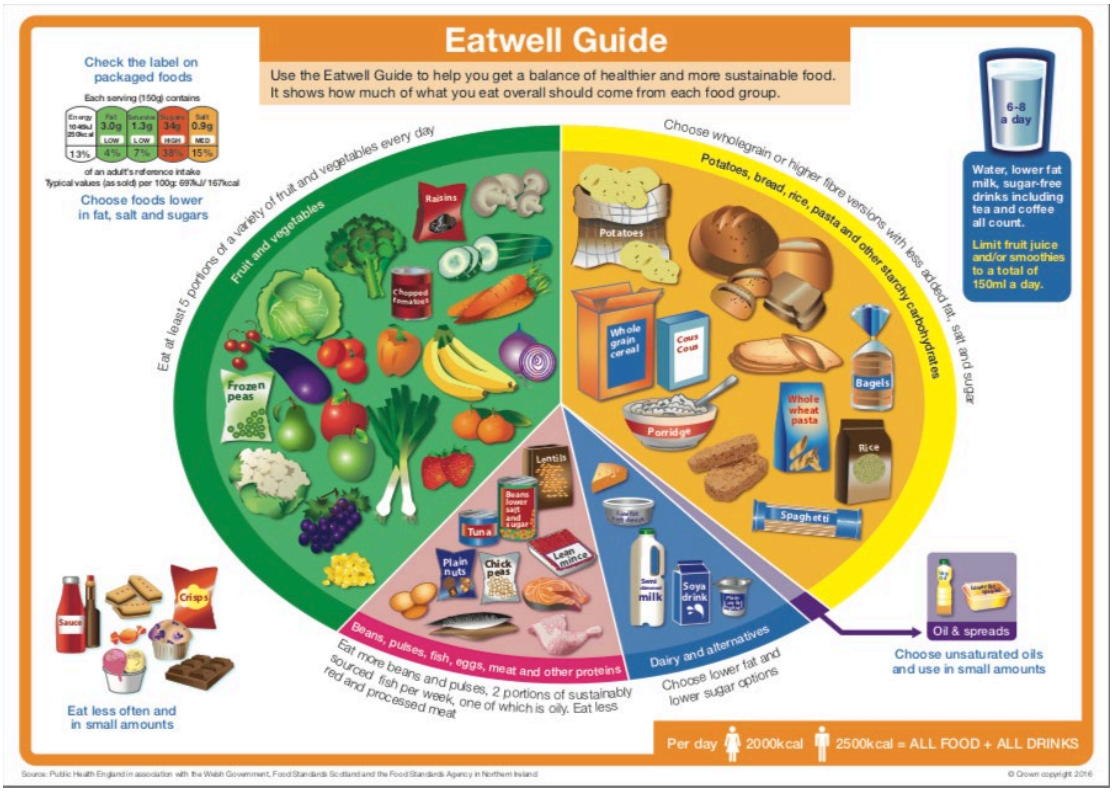
The elements of a plant-based diet are simple! It's about making fruit, vegetables wholegrains, pulses, nuts, seeds and meat alternatives such as soya, the centrepiece of our diets.

In the UK, Public Health England promotes The Eatwell Guide to help people understand the basics of a healthy, balanced diet. The image – which shows a plate filled with the main food groups we should choose and in the proportions we should have them – confirms we should be eating plenty of plant foods such as fruit, veg and starchy, fibre-rich foods such as oats, pasta, rice, potatoes and bread. At the same time, animal foods such as meat, poultry and dairy products are still included but in smaller amounts and plant alternatives are clearly highlighted[4]. A closer look

at the proportions for each group identifies that at least three quarters of the food we eat should be plant based[5].

The Eatwell Guide divides foods into four main groups:
- Fruit and vegetables
- Potatoes, bread, rice, pasta and other starchy foods
- Dairy and alternatives
- Beans, pulses, fish, eggs, meat and other proteins

Oils and spreads are included in a much smaller fifth group.



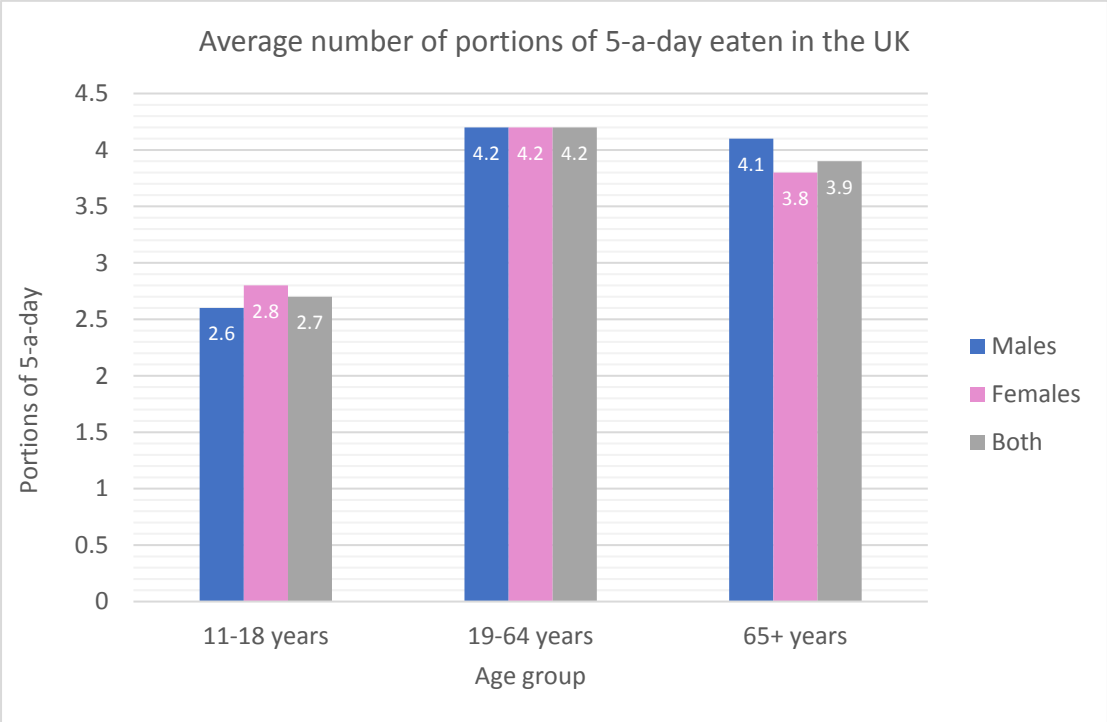

It's clear from this image that fruit and vegetables should make up a significant part of our diet.

In fact, the World Health Organization recommends at least 400g of fruit and veg are eaten daily to prevent obesity, heart disease, cancer and type 2 diabetes[6]. To help people understand how much fruit and veg they should eat, the UK government has taken this 400g target and divided it into five typical servings, each one weighing 80g. This is the basis for the 5-a-day campaign, which launched in 2003. The message – promoted via Public Health England – is simple: everyone should eat at least five portions of fruit and vegetables a day.

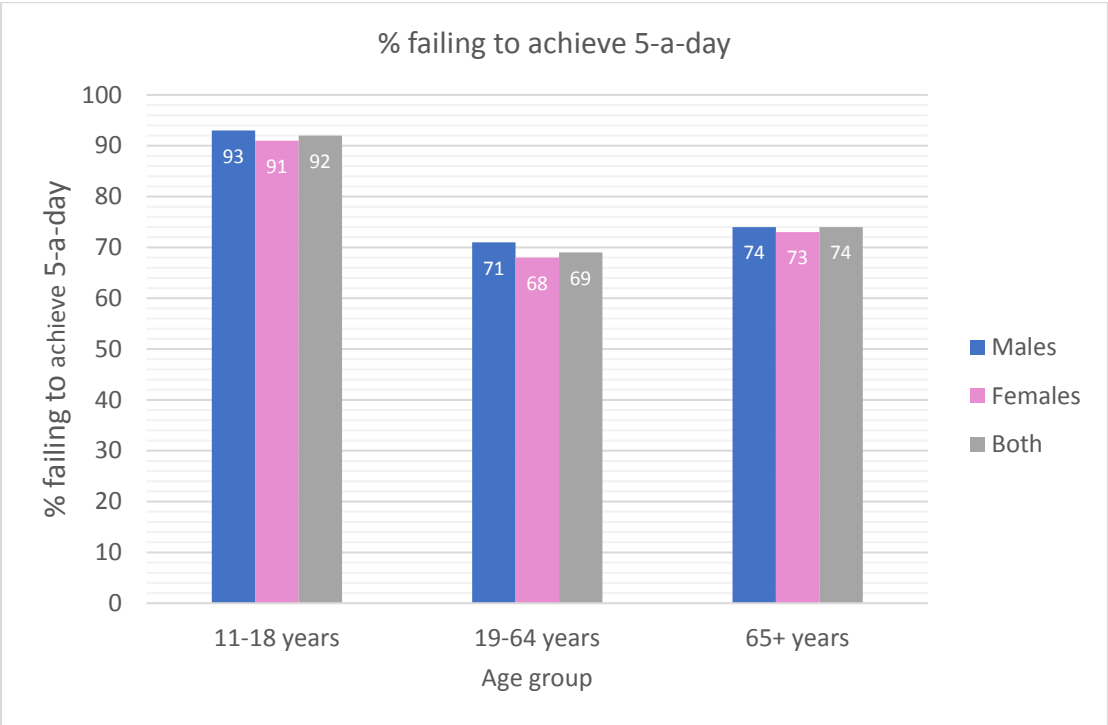
Yet though the campaign has been running for many years, studies show that while most people are aware of the 5-a-day message, when it comes to the detail – such as

what's included or what's a portion – they know far less[7,8]. And unfortunately, this lack of knowledge translates directly into a lack of fruit and veg in our diet.

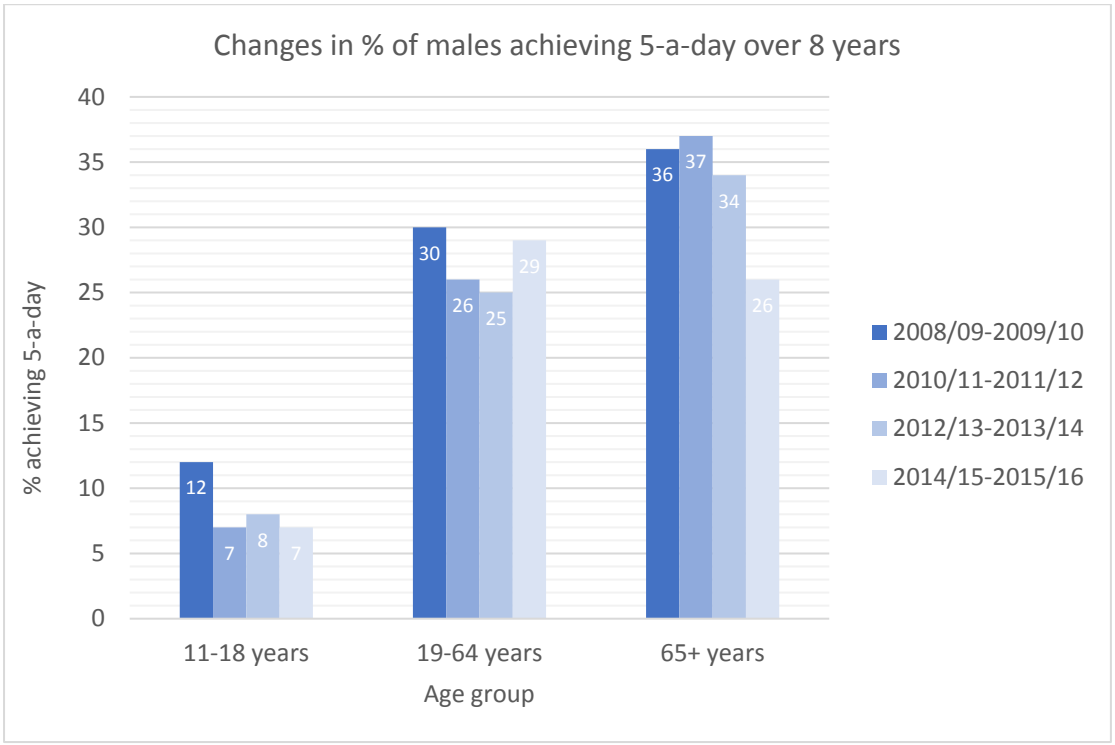
Indeed, figures from the National Diet and Nutrition Survey reveal that, on average, most of us struggle to achieve 5-a-day, with adults only managing four daily portions and teenagers, not even three portions[9].

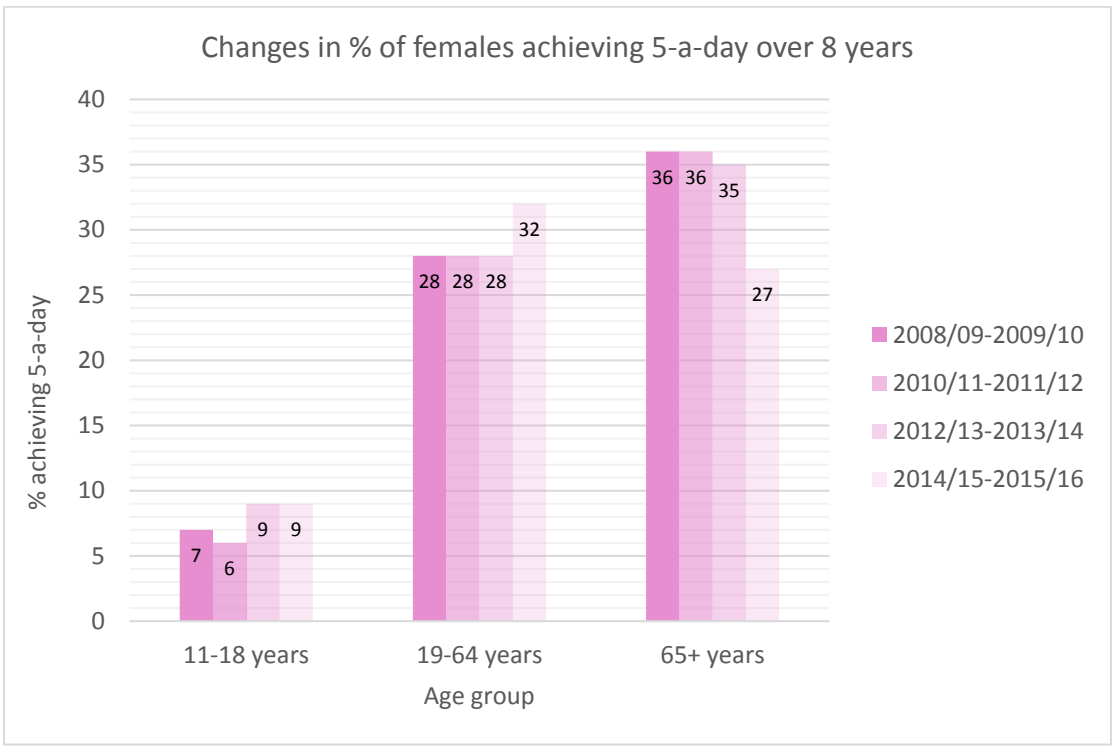



In fact, around seven out of 10 adults and a massive 92 percent of teenagers fail to hit five.




Worse still, intakes have changed little over the last eight years and in some groups of people, intakes actually seem to be falling rather than rising. For example, in 2009, 12% of teenage boys ate 5-a-day; by 2015, this had dropped to 7%.


Changes in % of males achieving 5-a-day over 8 years
% achieving 5-a-day
40
35
30
25
20
15
10
5
0
12
7
8
7
30
26
25
29
36
37
34
26
11-18 years
19-64 years
65+ years
Age group
2008/09-2009/10
2010/11-2011/12
2012/13-2013/14
2014/15-2015/16


Changes in % of females achieving 5-a-day over 8 years
% achieving 5-a-day
40
35
30
25
20
15
10
5
0
7
6
9
9
28
28
28
32
36
36
35
27
11-18 years
19-64 years
65+ years
Age group
2008/09-2009/10
2010/11-2011/12
2012/13-2013/14
2014/15-2015/16

Put simply, we're not eating enough fruit and veg! And this is not good news for living a long and healthy life. According to the World Health Organization, a lack of fruit and veg led to 3.9 million deaths around the world in 2017[10].

**Why are fruit and veg so important?**

The benefits of eating enough fruit and veg are many. At the top of the list is the important – but often forgotten – part they have in adding variety to our diet with their different tastes, textures and colours.

Then there are the health benefits. Numerous studies show that high intakes of fruit and veg mean we're less likely to suffer with diseases such as heart disease, stroke, type 2 diabetes, certain cancers and dementia[11,12,13]. Fruit and veg may also have a role in helping us manage our weight, probably because they are usually low in fat and calories, and often replace other foods in the diet that are higher in calories[14]. Indeed, data from the National Diet and Nutrition Survey confirms that fruit, for example, provides just one percent of the fat and four percent of the calories in the diets of UK adults[9].

But the many health benefits of fruit and veg aren't just limited to the fact they tend to be low in fat and only make a small contribution to calorie intakes. They're also an important source of many nutrients that help to keep us healthy and free from disease. They provide fibre, which helps keep our gut healthy by boosting good bacteria and making our stools large and soft, so they move easily through the large intestine. This in turn, may protect against constipation, piles and bowel cancer. They also supply a range of vitamins and minerals, with the exact types and amounts differing according to the variety.

Fruit and veg also provide naturally occurring phytochemicals. The main role of phytochemicals is to help plants thrive and protect them from disease, pests and ultraviolet light, so concentrations are often highest in the outer layers. Indeed, phytochemicals are often responsible for the rosy red, dark purple, vibrant orange or deep green colours of plants. But large amounts of research also show that phytochemicals probably have an array of health benefits. Many of these phytochemicals – of which there are tens of thousands, with many more still to be discovered – act as antioxidants and so may help protect our cells from free radical damage that's linked to disease[15].

It's an area of science that's constantly being studied. Yet at the moment, there's not enough information to make specific recommendations for the amounts or types of different phytochemicals we need to stay healthy. This is partly because it's impossible to study the specific health benefits of individual phytochemicals in people. These naturally occurring plant compounds don't exist in isolation – a plant may contain hundreds, even thousands, of them, along with fibre, vitamins and minerals that may also benefit health. Indeed, some studies suggest it's the unique package of nutrients in fruit and vegetables that work together to protect our health.

Often, when vitamins or antioxidant compounds are given in isolation in the form of supplements, they don't offer the same benefits and, in some cases, may even be harmful to our health[16].

Nevertheless, there is much lab-based research that provides good insight into the potential benefits certain phytochemicals – or groups of phytochemicals – may have in helping to prevent disease and promote optimum health. There are also many large human population studies that look at trends between health and intakes of certain phytochemicals and foods rich in them. Combined, this research enables us to draw conclusions that suggest certain types of phytochemicals may help to protect against certain health conditions and offer a host of health benefits.

**Is 5 enough?**

While the World Health Organization recommends 400g of fruit and vegetables a day[6] – a message that's translated into 5-a-day in the UK – several studies have shown that while five is good for health, more is even better. For example, a 2017 study found that every 200g increase in fruit and veg offered health benefits. An intake of 800g a day – double the recommendation from the World Health Organization and an amount equal to 10 portions – was considered the optimal intake, resulting in a reduced risk of premature death by 31 per cent[11]! Bottom line, it's likely that the more fruit and veg we eat, the greater the protection to our health. However, many people in the UK are still struggling to reach five portions so the focus needs to be on encouraging and helping the nation achieve 5-a-day, every day.

That's the purpose of this report. Commissioned by Pink Lady®, the report looks at the role apples can have in helping the nation achieve 5-a-day, every day. It outlines the many health benefits that have been linked to apple consumption and provides advice on how to encourage consumers to add a daily apple to their diet, taking teenagers closer to 5-a-day and adults from their current consumption of four daily portions of fruit and veg to reaching the recommended 5-a-day.

**WHY APPLES?**

Apples are already a popular fruit and firm favourite with UK consumers. This is important because research shows many consumers are creatures of habit when it comes to food and drink and feel more comfortable buying and consuming products, they are familiar with[17].

Data from Kantar Worldpanel confirms that based on the total volume purchased, apples are the No.2 choice for fruit in the UK, falling just behind bananas, but way ahead of easy peel citrus fruits, grapes and berries.

A further look at the data reveals that in 2018, 24 million people in the UK bought apples, spending more than £948 million on them. In total, 453 million kilos of apples were bought – that's more than 3.2 billion apples, assuming an average apple weight of 140g. Of those who purchased apples, the average amount bought was

18.9kg equal to 135 apples in the year or around 11 apples a month. *Reference 18 here. This is from data provided by Pink Lady®.*

The top three apples? Gala, Braeburn and Pink Lady®. For example, nearly 10 million people in the UK bought Pink Lady® in 2018 buying an amount equal to 53 million kilos. With a larger size of 175g per apple, it means more than 300 million Pink Lady® apples were sold!

**What makes apples such a good choice for boosting 5-a-day…**

• **It's easy to identify the amount that counts as one of our 5-a-day** – one apple equals one of 5-a-day

• **They're easily portable** – no need to be transported in a container making them great for on-the-go snacking

*Pink Lady® insight*
*"Putting an apple in my bag, might eat it, might not – but want something healthy on me in case I feel like snacking later on."*

• **They're easy to eat** – no peeling, chopping or slicing required and they're unlikely to leave hands sticky

• **There's minimum waste** – only the core to dispose of

• **They don't need to be kept chilled** – means they're perfect for on-the-go, even on hot days

• **There's no odour** – makes them great for eating in public places, where smells may bother others

• **They have a longer shelf life than many other fruits** – great news for reducing waste

• **They're versatile and suitable for anytime and anyplace** – they make a great snack but are equally good for breakfast, lunch or dinner, either for eating on their own or adding to other dishes.

*Pink Lady® insight*
*"I often have an apple with my lunch, it's a constant addition to my salads as are raisins, strawberries – I really like the mix of sweet and savoury and the juiciness or crunchiness is a good contrast to doughy carbs or salty meats."*

• **They're crunchy** – studies show the action of chewing helps to stimulate satiety signals and so may help with appetite control[19]

*Pink Lady® insight*
*"I like crunchy fresh apples so Braeburn and Pink Lady® are my first choice"*

• **They're naturally sweet** – the natural sugars they contain can help satisfy a sweet tooth without the fat or calories that often comes with other sweet foods such as chocolate, biscuits, doughnuts or cakes.

*Pink Lady® insight*
*"I almost always include these apples as I like the sweetness of them, and they're lovely and juicy! I don't usually have a dessert at lunchtime, so the sweetness of the Pink Lady® is enough to satisfy any need for one!"*

• **They fit with healthy eating guidelines** – apples are low in fat and salt, contain no added sugar and are a source of fibre. Regularly eating apples has also been linked to a variety of health benefits.

*Pink Lady® insight*
*"I felt a bit down today as I was having a bad day at work but after my apple, I felt uplifted as I had been good and not eaten chocolate!"*

• **Consumers like apples** – they're the second most popular fruit choice for UK consumers!

*Pink Lady® insight*
*"The Pink Lady® apple made my lunch healthy I feel. I ate it outside whilst on an errand to the shops and it was very warm and sunny outside, and this makes me enjoy apples."*

**The health halo effect of apple eating**
Eating apples seems to be linked to a better overall diet in children. In an American study of 2-18-year olds, those who consumed an apple a day ate more fruit overall and had significantly higher intakes of fibre, magnesium, potassium and iron, and lower intakes of total fat and saturates, compared to those who didn't eat apples. Intakes of total sugars were higher, but added sugar was lower. The apple-eating children were also more likely to meet nutritional recommendations for fibre and most vitamins and minerals[20]. Additional analysis of the data found those children who ate apples had an overall healthier diet, too – they ate more fruit, wholegrains, seafood and plant proteins, and fewer foods with empty calories. In addition, apple eaters had a lower Body Mass Index and were 30 percent less likely to be obese than those who didn't eat apples[21].

The findings from these two studies suggest that eating apples may be associated with overall diets that are richer in nutrients and closer to healthy eating guidelines. Why this is the case needs further research, but one possible explanation is that apples are eaten in place of other foods that are higher in calories, fat, added sugar and salt, but lower in fibre and nutrients.

**<u>What sets Pink Lady® apart?</u>**

• **You're guaranteed good quality** – consumers trust that with Pink Lady® they're getting a great quality apple. Research commissioned by Pink Lady® found it's the consistency of Pink Lady® apples that sets them apart from other apples – quite simply, you never get a bad one. One consumer explained it by referring to the many times she has bought clementines – the packaging might say sweet but often you get bland fruit that lacks in juice and you feel cheated and disappointed. You just don't have that experience with Pink Lady®.

*Pink Lady® insight*
*"Pink Lady® are normally quite perfect."*

• **Pink Lady® apples are never wasted** – consumers said Pink Lady® apples are never left in the fruit bowl to rot (a pet hate for many). People actually want to grab them and eat them as they taste so good.

*Pink Lady® insight*
*"They look nice in the fruit bowl… and don't hang around in the bowl long."*

• **They're a winner for their taste, smell and appearance** – consumers consistently rated Pink Lady® apples as tasting, smelling and looking superior to other popular varieties of apples such as Braeburn, Cox, Royal Gala, Jazz, Granny Smiths and Golden Delicious. They described Pink Lady® as being:

- Sweet
- Juicy
- Refreshing
- Crisp
- Fresh
- Crunchy
- Beautiful
- Perfect
- Blush Pink
- Good size
- Shiny

*Pink Lady® insight*
*"I chose Pink Lady® as I love the taste and also my children love them because of their colour and name."*

**About Pink Lady®**
Pink Lady® apples can be one of three varieties: Cripps Pink, Rosy Glow or Lady in Red. They're grown in orchards next to vineyards and are selected to be the most attractive apples for the market for which they're produced. At least 40 percent of their surface must be covered in a bright pink blush and they must be free from any bruising or blemishes. Pink Lady® apples must also meet set standards for their level of crispness and sweetness.

**NUTRITION FOR APPLES**

**What's in an apple?**

In the UK, nutrition information for apples is presented per 100g in the seventh edition of McCance and Widdowson's The Composition of Foods.

Typical serving sizes for small, medium and large whole apples are given in MAFF's Food Portion Sizes[22] as 75g, 112g and 170g, respectively. However, these portion sizes were compiled in 1993 and are not reflective of the size of apples currently sold in the UK, particularly for small and medium apples.

Pink Lady® took a sample of 60 apples covering eight varieties and calculated the average weights of whole apples to be 114g, 140g and 175g for small, medium and large, respectively.

According to McCance and Widdowson's The Composition of Foods, the core accounts for 13 percent of an apple, giving an edible weight of flesh and skin of 99g, 122g and 152g, respectively for small, medium and large.

The nutrition for apples and the contribution a large apple such as Pink Lady® makes to recommended intakes is outlined below.

| **Macronutrients** | **Per 100g (flesh only)** | **Per large apple (175g whole, 152g flesh)** | **Reference Intake (RI)[23]** | **% RI per apple** |
|---|---|---|---|---|
| Energy (kJ/kcal) | 215/51 | 327/78 | 8400/2000 | 4 |
| Fat (g) | 0.5 | 0.8 | 70 | 1 |
| Of which saturates (g) | 0.1 | 0.2 | 20 | 1 |
| Carbohydrate (g) | 11.6 | 17.6 | 260 | 7 |
| Of which sugars (g) | 11.6 | 17.6 | 90 | 20 |
| Fibre (g) | 1.2 | 1.8 | 30* | 6 |
| Protein (g) | 0.6 | 0.9 | 50 | 2 |
| Salt (g) | 0 | 0 | 6 | 0 |

| **Minerals** | **Per 100g (flesh only)** | **Per large apple (175g whole, 152g flesh)** | **Nutrient Reference Value (NRV)[22]** | **% NRV per apple** |
|---|---|---|---|---|
| Potassium (mg) | 100 | 152 | 2000 | 8 |
| Calcium (mg) | 5 | 8 | 800 | 1 |
| Magnesium (mg) | 4 | 6 | 375 | 2 |
| Phosphorus (mg) | 8 | 12 | 700 | 2 |
| Iron (mg) | 0.1 | 0.1 | 14 | <1 |
| Copper (mg) | 0.03 | 0.05 | 1 | 5 |
| Zinc (mg) | 0 | 0 | 10 | 0 |

| | | | | |
|---|---|---|---|---|
| Manganese (mg) | 0.04 | 0.06 | 2 | 3 |
| Selenium (mcg) | 0 | 0 | 55 | 0 |
| Iodine (mcg) | 4 | 6 | 150 | 4 |

| **Vitamins** | **Per 100g (flesh only)** | **Per large apple (175g whole, 152g flesh)** | **Nutrient Reference Value (NRV)[22]** | **% NRV per apple** |
|---|---|---|---|---|
| Vitamin A (mcg) | 2 | 3 | 800 | <1 |
| Vitamin D (mcg) | 0 | 0 | 5 | 0 |
| Vitamin E (mg) | 0.09 | 0.14 | 12 | 1 |
| Vitamin K (mcg) | 5.6 | 8.5 | 75 | 11 |
| Thiamin (B1) (mg) | 0.04 | 0.06 | 1.1 | 5 |
| Riboflavin (B2) (mg) | 0.04 | 0.06 | 1.4 | 4 |
| Niacin (B3) (mg) | 0.1 | 0.15 | 16 | <1 |
| Vitamin B6 (mg) | 0.07 | 0.11 | 1.4 | 8 |
| Vitamin B12 (mcg) | 0 | 0 | 2.5 | 0 |
| Folate (mcg) | 0 | 0 | 200 | 0 |
| Pantothenic acid (mg) | 0.1 | 0.15 | 6 | 3 |
| Biotin (mcg) | 1.1 | 1.7 | 50 | 3 |
| Vitamin C (mg) | 6 | 9 | 80 | 11 |

* There is no Reference Intake for fibre. However, Public Health England recommends 30g fibre daily. This is based on the amount recommended by the Scientific Advisory Committee's report on Carbohydrates and Health[24].

## Nutrition claims

Current food labelling legislation on nutrition and health claims allows the following claims to be made for apples[25]:

- **FAT FREE** (criteria ≤0.5g/100g)
- **SATURATES FREE** (criteria ≤0.1g/100g)
- **SALT FREE** (criteria ≤0.01g/100g)
- **SOURCE OF FIBRE** (≥1.5g fibre/100kcal)

According to Public Health England:
1 apple = 1 of our 5-a-day

## Beyond vitamins and minerals

While apples don't make a large contribution to recommended vitamin and mineral intakes, scientific studies reveal they provide a range of phytochemicals, especially from the polyphenol group[26].

Polyphenols are one of the largest and most studied groups of phytochemicals with more than 8,000 compounds having been identified. Diets rich in polyphenols have

been shown to offer protection against certain cancers, cardiovascular disease, type 2 diabetes, asthma and other lung conditions, gastrointestinal conditions, and neurodegenerative diseases[27,28].

Polyphenols can be further broken down into smaller groups. Flavonoids are one of the most abundant subclasses of polyphenols, accounting for around 60% of all polyphenols. More than 4,000 flavonoids have been identified.

And this is where apples shine! They contain flavonoids, particularly quercetin (from the flavonols group) and epicatechin and catechin (both from the flavanols group)[29] as well as phloridzin, which is especially abundant in the peel[26]. Pink Lady®, like other red skinned apples, also contain anthocyanins – flavonoids that typically provide a red colour[30]. It's these flavonoids in apples that are thought to contribute to the many health benefits that have been shown in studies[31].

The benefits don't just stop with flavonoids, either. Phenolic acids are another of the subclasses of polyphenols, and apples contain a variety of these, too, including chlorogenic acid, coumaric acid and gallic acid[26]. Whilst less well studied than flavonoids, research is increasingly suggesting that phenolic acids may also have a variety of health benefits.

So, is it true that '*an apple a day keeps the doctor away*'?

## PART 2 THE HEALTH BENEFITS OF APPLES

The saying '*an apple a day keeps the doctor away'* is thought to have originated in Wales in the 1860's. Back then, it appeared in a slightly different format: *Eat an apple on going to bed and you'll keep the doctor from earning his bread*. Passed down through the generations, the saying we're now more familiar with first appeared in 1913.

But can an apple a day *really* keep the doctor away?

In 2015, American researchers set out to discover the answer in a study that included 8,400 adults. They found whilst there was no difference in the number of visits to the doctor or overnight hospital stays in those who ate an apple a day versus those who didn't, the daily apple eaters did seem to use fewer prescription medicines[32]. The researchers concluded that, if anything, an apple a day may be more likely to keep the pharmacist – rather than the doctor – away.

Nevertheless, there has been a wealth of research carried out looking at the link between apple consumption and health and disease. In one of the most recent large reviews assessing the impact of fruit and vegetables on health, high intakes of apples (and pears) compared with low intakes were found to be linked with a 20 percent lowered risk of death from any cause[11].

A study of elderly Australians reported even greater results. Researchers followed women aged over 70 years for 15 years and found those who ate at least one small apple a day had a 35 percent lower risk of death compared to those who didn't eat apples[33].

Studies suggest it's a reduction in the risk of major diseases such as cardiovascular disease, stroke and certain cancers that may be responsible for the overall reduction in mortality. But apples have also been linked to lowering the risk of several other diseases, too.

The following section looks at some of the health benefits linked to apple consumption.

Apples or Pears?
Researchers often put apples and pears together when looking at eating habits and their impact on health. However, apples are far more commonly consumed than pears – around the world, people eat 3.5 times more apples than they do pears[34].

## HEART HEALTH

Many studies suggest that good intakes of flavonoids – whatever the dietary source – may have beneficial effects on heart health. For example, a review of 15 studies

found there was a 14 percent reduced risk of death from cardiovascular disease with the highest intakes of flavonoids compared with the lowest intakes[35]. Other studies have focussed on specific flavonoids and shown them to have a protective role. A recent study of elderly Dutch men, for example, found the risk of dying from coronary heart disease was 38 percent lower in those who had the highest intakes of a flavonoid called epicatechin than those who had the lowest intakes. Apples (together with tea and cocoa) were identified as one of the main dietary sources of epicatechin in their diets[36].

Apples themselves have been linked to a lower risk of heart disease, too. A Finnish study of more than 5,000 adults found that men with the highest apple intakes had a 19 percent lower risk of dying from a heart attack than those with the lowest intakes; women had a 43 percent reduction[37].

An even bigger study of more than 35,000 postmenopausal women found those who ate more than one serving of apples (and pears) a week had a 13 percent reduced risk of dying from cardiovascular disease and a 15 percent reduction of dying from coronary heart disease[38].

Apples may also help to protect against hypertension or high blood pressure, one of the main risk factors for strokes and heart attacks. When the results of three large ongoing studies were combined – including 187,000 people in total – those who ate four or more apples (or pears) a week had a nine percent lower risk of developing hypertension than those who consumed less than one apple a month[39].

With results like this, it's unsurprising that apple intakes have been associated with fewer strokes. For example, Swedish research looking at apple intake and stroke over 10 years in almost 75,000 adults found there was an 11 percent reduction in the risk of having a stroke in those with the highest intakes of apples (and pears) compared with those eating the least[40].

Finnish researchers found apples offered even greater protective against strokes. Higher intakes of apples were associated with a significantly reduced risk of thrombotic stroke in both men and women – those who ate the most had around a 40% lower risk compared with those who ate the least[41].

A review of 95 studies published in 2017 sums up much of the evidence succinctly. Quite simply, the highest intakes of apples (and pears) compared with the lowest intakes were associated with a lower risk of stroke, coronary heart disease and cardiovascular disease[11].

More research is needed to identify just how apples aid heart health. But lab-based studies suggest one mechanism may be through their ability to lower total and/or LDL (or bad) cholesterol[42]. Indeed, a few small studies in humans suggest apples may have a positive effect on blood cholesterol levels, although the amount consumed is

usually more than ‘an apple a day’. For example, a review looking at the effect of apples on blood cholesterol concluded there was a cholesterol lowering effect in the range of five to eight percent, but this was with a consumption of three apples a day[43].

Meanwhile, a study of 160 post-menopausal women found those who consumed 75g dried apple a day – an amount equal to two small fresh apples – lowered their total cholesterol by nine percent, and their LDL cholesterol by 16 percent after three months. The cholesterol lowering benefits didn’t stop there, either. After six months, total cholesterol was down by 13 percent, and LDL cholesterol by 24 percent[44].

How do apples lower cholesterol? It’s an area that needs more research – most studies tend to be lab-focused rather than undertaken with humans – but in general it’s thought the flavonoids in apples may be partly responsible. Plus, some of the benefit may come from pectin, a soluble fibre that’s been shown to have a favourable effect on blood cholesterol levels[45]. Within the European Union, there is even an approved health claim that can be used on foods that provide a daily intake of 6g pectin: *Pectin contributes to the maintenance of normal blood cholesterol levels*[46].

The amount of pectin in fruit depends on the variety, the part of the fruit (peels often contain the most pectin) and the degree of ripeness. Studies show the pectin content in apples varies anywhere from 0.1g to 1.2g pectin per 100g. One study suggests an average of 0.6g per 100g, so a large 175g apple would be expected to provide around 1.1g pectin[47].

How pectin lowers cholesterol is thought to be through its ability to bind with cholesterol in the intestine, which stops it being absorbed into the blood.

Meanwhile, the role apples have in benefitting heart health might not be solely due to their potential to lower cholesterol. Other studies show apples may help to maintain a healthy heart by having a positive effect on blood vessels. For example, a small study involving 30 adults at risk of heart disease found apples, eaten both in the short term and after four weeks, helped to improve the ability of arteries to dilate or widen when blood flow increased in them[48]. This is important for helping to keep blood flowing easily through the vessels. Interestingly, these effects were only seen in unpeeled apples (and not peeled ones), building on other research that suggests flavonoids – which are more concentrated in the peel – may be responsible for this effect[49].

Meanwhile, apples are free from fat, saturates and salt, and are a source of fibre – all of which have been linked to a lower risk of cardiovascular disease and stroke in numerous studies. Eating apples in place of other foods that are high in fat, saturates and salt, may therefore help to reduce intakes of these nutrients.

So, are apples a useful dietary addition for a healthy heart? Researchers from the University of Oxford created a theoretical model to see what would happen if 70 percent of Brits over the age of 50 were prescribed either a statin (a drug that helps to lower cholesterol) or an apple each day. The researchers found, in theory, there would be similar reductions in death rates with both. The conclusion: a 150-year old health promotion message is able to match modern medicine – and is likely to have fewer side effects[50].

**CANCER**

There's growing evidence that fruit may help reduce the risk of some cancers. According to the World Cancer Research Fund (WCRF), fruit most likely protects against cancers of the mouth, pharynx, larynx and oesophagus, and may also offer protection against lung cancer in smokers and ex-smokers. Foods containing fibre, such as fruit, help to lower the risk of bowel cancer, too[51].

Good intakes of fruit have also been linked to lower Body Mass Index (BMI), body weight and waist circumference, and have been shown to aid weight loss, and prevent weight gain[52]. This suggests fruit is a good choice for helping people achieve and/or maintain a healthy weight, which in turn, may help to protect against many cancers. According to the WCRF there's strong evidence that being overweight or obese throughout adulthood increases the risk of 14 different cancers, including those of the mouth, pharynx, larynx, oesophagus, stomach, pancreas, gallbladder, liver, bowel, breast (postmenopausal), ovaries, endometrium, prostate and kidney[51].

But while evidence from the WCRF tends to focus on fruit in general, many studies also suggest apples specifically may help to protect against cancer.

In one study of elderly Australian women, those who ate at least one small apple a day over 15 years had a 47 percent lower risk of dying from any type of cancer than those who didn't eat apples[33].

Meanwhile, a study of more than 6,000 adults from Italy looked at the link between apple intakes and the risk of specific cancers. Eating one or more apples a day (using an apple weight of 166g) compared to eating less than one apple a day reduced the risk of cancers of the mouth and pharynx by 21 percent, of the oesophagus by 25 percent, of the bowel by 20 percent, larynx by 42 percent, breast by 18 percent, ovaries by 15 percent and prostate by nine percent[53].

One of the strongest associations is the protection apples appear to offer against lung cancer. In the year 2000, research that analysed data from two large studies including 125,000 adults found that women who ate at least one apple (or pear) a day had a 37 percent reduced risk of lung cancer[54]. Similar results were seen in a Hawaiian study that same year, which found the highest apple intakes were

associated with a 40 percent reduced risk of lung cancer compared with the lowest intakes[55].

Several years later, an analysis of fruit and vegetable consumption and lung cancer risk from the European Prospective Investigation into Cancer and Nutrition found a more modest, though still significant, reduction. Those with the highest intakes of apples (and pears) compared to those with the lowest intakes had a 15 percent lower risk of lung cancer. For smokers, higher intakes of these fruits reduced the risk by 20 percent[56].

Meanwhile, a more recent review from 2016 found the risk of lung cancer was reduced by up to 25 percent in those with the highest versus lowest apple intakes[57]. This review also found a reduction in colorectal (bowel), breast and digestive tract cancers in some studies.

Indeed, other studies have shown a link between apple intakes and a reduced risk of bowel cancer. In research that compared two groups of hospital patients, one group with colorectal cancer and the other without a history of cancer, eating at least one apple a day was found to lower the risk of colorectal cancer by 35 percent. Consuming more than one apple daily reduced the risk by 50 percent[58]. Similarly, an Australian study found the highest intakes of apples lowered the risk of distal colon cancer (the part of the bowel on the left side and the S-shaped section that connects to the rectum) by 49 percent when compared with the lowest intakes[59].

Numerous studies suggest it's the polyphenols such as the flavonoids and phenolic acids, in apples that are probably responsible for many of their cancer protective effects[60]. These naturally occurring plant chemicals have been shown in lab tests, for example, to stop tumours from forming, to interfere with their development and to kill cancer cells. Many of the compounds in apples also have antioxidant activity and so can help to mop up an excess of free radicals before they have a chance to run riot in the body and damage the DNA of cells, which can be a precursor for cancer[61].

Meanwhile, the link between high apple intake and the lower incidence of certain cancers may be partly thanks to apples replacing other foods in the diet that are less nutritious and higher in calories, saturated fat or sugar.

Whatever the reason, much of the research suggests eating an apple each day as part of an overall healthy diet and lifestyle that includes plenty of fruit and veg, may help to protect against some forms of cancer.

## LUNG HEALTH

While research has suggested that good intakes of apples may have a role in protecting against lung cancer, some studies also reveal eating apples may improve overall lung health.

For example, a study of more than 2,500 Welsh men found those who ate at least five apples a week had better lung function than those who ate none[62].

In the Netherlands, a study of more than 13,000 adults found that apples (as well as catechins – one of the main flavonoids in apples) was linked to improved lung function and fewer symptoms of chronic obstructive pulmonary disease[63]. Research including participants from the UK, Germany and Norway also found that over a decade, higher intakes of apples were associated with a slower decline in lung function, especially in ex-smokers[64].

Eating apples may also help to protect against asthma. A British study in 2001 found that asthma was less common in adults who ate at least two apples a week[65]. Similarly, a 2003 Australian study involving 1,600 young adults found that eating apples (and pears) was linked to a 17 percent decreased risk of asthma as well as less bronchial hypersensivity[66]. A few years later, a study found higher apple intakes were linked to a marginally lower incidence of asthma in more than 2,100 French women[67]. Interestingly, one study found a lower incidence of wheezing and asthma in five year-old-children born to mothers who ate the most apples during their pregnancy. The researchers concluded that the consumption of apples during pregnancy may have a protective effect against the development of childhood asthma and allergic disease[68].

Indeed, the benefits of eating apples on lung health may well extend to children. In a study of 7-18-year-old children from the Greek island of Crete, eating apples was found to be protective against wheezing and rhinitis (inflammation of the nose lining)[69].

The link between apples and lung health is one that certainly warrants more research. But one thing is for sure: apples look like they're probably a good addition to our diet for healthy lungs.

**TYPE 2 DIABETES**

Good intakes of fruit and vegetables can help us manage our weight, and this is crucial in both the prevention and treatment of type 2 diabetes, a condition that affects 4.7 million people in the UK[70]. Higher intakes of fruit (and green leafy veg) have also been directly linked to a lower risk of the disease itself[13].

As apples are one of the most commonly consumed fruits in the UK, it's unsurprising that research is increasingly being carried out to see if apples alone offer protection against type 2 diabetes. It's an area that needs further investigation, but so far, a few large studies have shown promising results.

An on-going Finnish study with more than 10,000 participants found that higher intakes of quercetin – a flavonoid found in apples – as well as apples themselves, were linked to a lower incidence of type 2 diabetes[71].

In an even larger piece of research that combined the results of three studies to give a total of more than 187,000 people, three apples a week were found to reduce the risk of type 2 diabetes by seven percent[72].

Even greater reductions were seen in a study of 38,000 healthy women who were followed over almost nine years. Those who ate at least one apple a day had a 28 percent reduced risk of type 2 diabetes compared with those who ate no apples[73].

Most recently, a review of studies estimated that apples (and pears) lowered the risk of developing type 2 diabetes by 18 percent[74].

Apples probably offer their protection in a variety of ways. Firstly, they have a low glycaemic index (GI), which means the natural sugars they contain are absorbed slowly, which can aid blood glucose control. Indeed, research shows that choosing low-GI foods helps people with type 2 diabetes manage their blood glucose levels[75].

Part of the reason for their low GI may be because apples contain pectin, which combines with water to form a gel in the stomach. This gel slows down the absorption of sugars into the blood, in turn helping to keep blood glucose levels steadier. It also delays the emptying of the stomach, helping to improve feelings of fullness.

Evidence is also growing to suggest that polyphenols may affect blood sugar levels and improve insulin sensitivity, both of which are important for the prevention and management of type 2 diabetes[76].

Finally, apples may be consumed in place of foods that are higher in calories, and so may help people manage their weight more effectively. This in turn, is vital for protecting against type 2 diabetes, as well as treating the condition.

## WEIGHT MANAGEMENT

Fruit is known to have an important part to play in weight management[14,52]. Despite it containing natural sugars, studies consistently show that good intakes help people maintain their weight more easily as well as aiding weight loss.

Specific research on the effect apples can have on waistlines is limited. However, one piece of research that looked at fruit and veg consumption and changes in body weight in 133,000 adults found that higher intakes of apples (and pears) were linked to a weight loss of 1.2lb (0.6kg) over four years[77].

In a smaller study, 49 overweight Brazilian women were asked to add either an apple, a pear or an oat cookie three times a day to their normal diet. All provided the same number of calories and similar amounts of fibre. After 10 weeks, those who ate the apples lost 2lb (0.9kg) and the pears 1.8lb (0.8kg) whereas those who ate the cookies had no significant weight loss[78].

Apples, like other fruits, are likely to benefit waistlines in a number of ways. While studies reveal that polyphenols may have anti-obesity effects[79], the favourable effects of apples may simply be due to the positive impact they have on calorie intakes. For example, a large apple such as a Pink Lady® has 78 calories – that's just four percent of the Reference Intake, which is set at 2000 calories daily. Thanks to being naturally sweet, Pink Lady® apples may be eaten in place of other sweet foods such as chocolate, biscuits, pastries and cake that typically come packaged with far more calories (as well as fat, saturates and sometimes salt).

The following chart compares the nutrition of a large apple with several other popular sweet foods.

| | 1 large apple (175g) | 1 small bar milk chocolate (50g) | 1 jam doughnut (75g) | 1 coffee-shop blueberry muffin (116g) |
|---|---|---|---|---|
| Energy (kJ/kcal) | 327/78 | 1086/260 | 1014/241 | 1714/409 |
| Fat (g) | 0.8 | 15.6 | 9.8 | 19 |
| Saturates (g) | 0.2 | 9.4 | 3.8 | 3.1 |
| Carbohydrates (g) | 17.6 | 28 | 36.3 | 53 |
| Sugars (g) | 17.6 | 28 | 15.2 | 23 |
| Fibre (g) | 1.8 | 1.2 | 1.3 | 1.3 |
| Protein (g) | 0.9 | 3.7 | 4.1 | 5.8 |
| Salt (g) | 0 | 0.1 | 0.8 | 0.4 |

The potential calorie savings made by swapping a typical sugary snack for an apple can make a big difference to waistlines over time. For example, eating a large apple in place of a 50g bar of milk chocolate saves 182 calories. Make this change every day and over a year that would give an annual saving of 66,430 calories. It's widely accepted that an energy deficit of 3,500 calories results in a loss of around 1lb (0.45kg). This means a simple daily swap of a small bar of chocolate for a large apple could result in a weight loss of around 19lb (8.6kg) in a year, providing there are no other changes to diet or activity levels.

Apples may also help to aid satiety or that feeling of fullness after eating. Australian research found apples are one of the top four foods for satisfying hunger, above even wholemeal bread, brown rice, All-bran, baked beans, bananas and grapes[80]. Their fibre content is likely to contribute to this – apples provide pectin, a form of soluble fibre that helps to slow down the speed at which the stomach empties[81]. This in turn can help to keep us feeling fuller for longer. Meanwhile, the low glycaemic index of apples also helps to keep blood sugar levels more even, preventing sudden

drops that can trigger hunger[79]. Finally, the crunchy nature of apples also means they need a lot of chewing. This may aid weight management as more chewing has been shown in studies to slow down the speed of eating, improve satiety and reduce food intake[82].

**BRAIN FUNCTION**

Many studies link high intakes of fruit and vegetables with a reduced risk of cognitive impairment and dementia[83]. Other studies have found that good intakes may improve mood and mental wellbeing[84,85].

Very few studies though have looked specifically at the role apples may have in keeping the brain healthy. Lab-based studies have found that concentrated apple juice may have a positive effect on some of the processes involved in the development of Alzheimer's disease[86]. However, far more research is needed in humans – and with intakes of whole apples – before any firm conclusions can be made about apples and the impact they may have on the health of the brain.

Studies have, however, looked at the role polyphenols may have on brain function, particularly in relation to the aging process and conditions such as Alzheimer's disease[27]. Much of the focus has been on flavonoids, which have been shown to affect cognition and even reverse declines in memory and learning associated with getting older[87]. For example, one piece of research looked at flavonoid intakes in adults aged 65 years or older over a 10-year period. Those with the highest intakes of flavonoids at the start of the study had better cognitive function than those with the lowest intakes. Plus, they had better cognitive evolution over the study period. In other words, higher intakes of flavonoids seemed to slow down the loss of cognitive function typically seen with aging[88].

Another study of almost 14,000 women found that higher intakes of flavonoids at midlife increased the chances of healthy aging (defined as living to at least 70 years with no major chronic disease or major impairments in cognitive or physical function or mental health)[89]. When individual fruits were looked at, the study found higher intakes of apples were linked to healthy aging.

It's still not known exactly how flavonoids work to enhance brain function, but studies suggest they may help to protect the nerve cells, encourage the growth and development of new nerve cells, boost nerve function and stimulate blood flow in the brain.

Meanwhile, a few small studies have linked apples (as well as other fruits) to mental wellbeing. One study of 100 students found that snacking on one piece of fruit – either an apple, clementine or banana – every day for 10 days was associated with less anxiety, depression, emotional distress and fewer cognitive difficulties compared to daily snacking on chocolate or crisps[90]. Eating raw fruit (and veg) rather

than cooked or canned was also linked to fewer symptoms of depression, a more positive mood and improved satisfaction with life in a study of 422 young adults. Apples were pinpointed as one the main fruits that were linked to better mental health[91].

Whilst there's clearly a need for more research, it certainly seems that good intakes of fruit (and veg) throughout life may have a positive impact on mental wellbeing and protect the brain from the declines in memory and cognition that are associated with aging. Eating an apple every day is an easy way to add more fruit to diets.

**ORAL HEALTH**

It's well established that a healthy diet can protect teeth from decay and keep gums healthy. But when it comes to fruit there's some controversy due to the fact it contains a combination of natural sugars and acid.

Both sugars and acid are potentially harmful for teeth. Sugar that's left behind after eating and drinking reacts with the bacteria in plaque (the sticky coating on the teeth) to form acids that attack the teeth and destroy the enamel. When this happens frequently, the tooth enamel starts to break down, eventually forming a hole or cavity in the dentine (the part of the tooth just below the surface of the enamel). Once this happens, the tooth can decay more quickly. Meanwhile, acidic foods and drinks can gradually dissolve the tooth enamel, a process called dental erosion.

In 2011, a study published in the Journal of Dentistry found the acidic nature of apples damaged the dentine (but surprisingly not the enamel)[92]. However, dental organisations recognise the importance of eating fruit as part of a balanced diet and tend to agree that fruit is only damaging to teeth if unusually large amounts are eaten. On the other hand, most organisations recommend limiting dried fruit and fruit juice (or diluting it with water) and having it at mealtimes rather than as a snack. This is because the sugars are more concentrated[93,94].

It's also important to look at the foods that fruit such as apples might be replacing in diets. Chocolate, biscuits, sweets, ice cream, cakes and pastries are often eaten as snacks and to satisfy a craving for something sweet. However, these foods are known to be potentially harmful to teeth, especially if eaten frequently, due to their high sugar content. While dentists often recommend limiting snacking altogether, it's generally accepted that fresh fruit – which also comes packaged with fibre and antioxidants – is a much better choice than foods that come with a lot of added sugar, as well as calories and fat.

The concept of eating an apple at the end of a meal to clean teeth is now somewhat outdated. The theory was based on the idea that crunchy apples need plenty of chewing, which stimulates the production and flow of saliva. This helps to wash

away particles of food and reduce the acidity of the mouth, therefore helping to reduce dental plaque. However, the results of studies looking at whether apples do actually help to eliminate or lessen plaque have been mixed, with some suggesting they reduce the accumulation of plaque and others suggesting they have no effect[95]. The most recent study was carried out in 2018 on 20 adults aged 20-25 years. The results found that chewing an apple didn't remove plaque and may even favour plaque regrowth over 24 hours. However, it did reduce the vitality of bacteria in the saliva to a level similar to that seen after brushing teeth[90]. What this means in essence, is that eating an apple isn't as beneficial to teeth as brushing them with a toothpaste that contains fluoride.

So, are apples good or bad for teeth? The general consensus is that fresh fruit – including apples – is an important part of a balanced, healthy diet and can be eaten without harming teeth. Eating apples in one go – rather than grazing on them slowly – will reduce the length of time the teeth are exposed to their natural sugars and acid. After eating them, having a glass of water will help to reduce the acidity in the mouth. Meanwhile, eating them with a small cube of reduced-fat cheese will help to neutralise the acidity in the mouth.

A review on apples and oral health sums things up with a simple conclusion: apples may be beneficial for overall and oral health but the removal of plaque through brushing, flossing and fluoride therapy remain the most important measures to preserve oral and dental health[96].

## GUT HEALTH

Apples are a source of fibre, a component that's lacking in the diets of many people in the UK. According to the National Diet and Nutrition Survey, on average, adults have 19g fibre a day[9]. However, based on recommendations made by the Scientific Advisory Committee's report on Carbohydrates and Health[24], Public Health England recommends a daily intake of 30g fibre. A large apple contains 1.8g fibre – that's six percent of the daily fibre recommendation. Fibre keeps the digestive system working properly and helps to soften the stools, preventing constipation, diverticular disease and haemorrhoids (piles). It also promotes the growth of 'friendly' bacteria in the large intestine. Foods containing fibre, such as fruit, help to lower the risk of bowel cancer, too[51].

Apples contain a mixture of insoluble fibre, including cellulose and hemicellulose, and soluble fibre such as pectin. Insoluble fibre is the type that adds bulk to stools, making them easier to pass. This type of fibre, in particular, helps to prevent bowel complaints, such as constipation and bowel cancer, as it helps waste products to pass smoothly through the body. Indeed, eating one or more apples a day compared to eating less than one apple a day has been shown to be linked with a 20 percent reduction in the risk of developing bowel cancer[53]. Another review of studies found

that the highest intakes of apples were linked to a 28 percent reduction in the risk of bowel cancer compared to the lowest intakes[57].

Soluble fibre also helps to increase the bulk of stools. But in addition, it forms a gel-like substance that can bind to other substances in the gut. This helps to lower cholesterol levels and slows down the absorption of glucose into the blood, improving blood sugar levels. Thanks to its gelling ability, soluble fibre also helps to slow down the speed the stomach empties, which can aid satiety or the feeling of fullness[81]. Meanwhile, pectin acts as a prebiotic and feeds the friendly or probiotic bacteria in the gut. This helps them to grow and flourish.

Studies also show that pectin helps to promote a healthy, anti-inflammatory gut microbiota[97] – the name given to the tens of trillions of microorganisms living in the gut. These microorganisms are mainly bacteria that belong to more than 1,000 different species[98].

It's not just fibre that reaches the large intestine either. Many polyphenols – up to 90 percent, in fact – aren't absorbed in the upper gastrointestinal tract and so, like fibre, reach the large intestine[99]. Here, they can affect the overall composition of the gut microbiota.

The composition of the gut microbiota is especially important because it can affect health in many ways. As well as playing an important part in digestive health, the microbiota is important for a healthy immune system. It's also vital for helping to maintain the integrity of the gut lining, which functions as a barrier to disease-causing substances or antigens (substances that trigger the immune system to produce antibodies). It also has a role in making some vitamins such as vitamins B12 and K[100].

There seems to be a link between the gut microbiota and many health problems, too. Less diversity and changes in the gut microbiota have been linked, for example, to obesity, type 2 diabetes, irritable bowel syndrome and even cancer and neurodegenerative diseases[101], although it's not known whether the conditions cause these changes or are the result of it.

Unsurprisingly, diet has a major impact on the gut microbiota – the type and quantity of food components that reach the large intestine affect both the composition and activity of the microbiota. Indeed, lab-based research looking at different apple varieties, including Pink Lady®, found they changed the diversity, composition and activity of the gut microbiome in ways that could benefit health[102]. Meanwhile, a small study of just eight adults indicated that when two apples a day were consumed for a fortnight, the intestinal environment improved. Apple pectin was one of the components identified as being responsible for this[103].

The effects of apples on the gut microbiome needs to be researched in much greater depth and studies in humans are needed before any firm conclusions can be made. But early studies suggest apples may well have a positive impact on the gut microbiome, which in turn may have a positive impact on health.

## PART 3 APPLES IN THE DIET

It's clear that apples are linked to a great many health benefits and offer a simple way to add an extra portion of fruit to daily diets, making it easier to achieve the recommended 5-a-day. This section provides advice on how to maximise the health potential of apples, plus gives tips on buying, storing and adding them to diets.

### Whole fruit or apple juice?

While fruit juice can make an important contribution to a healthy, balanced diet, Public Health England recommends limiting pure juices to just one small glass (150ml) a day[4]. This is because juices don't provide the fibre of whole fruit. An apple contains around 1.8g fibre whilst a 150ml glass of clear apple juice – which contains none of the pulp or peel – is free from fibre. Pressed or cloudy varieties of apple juice may contain some fibre, although in lower amounts than whole apples.

The pulp and peel of apples don't just provide fibre, either. They're also rich in polyphenols. Indeed, whole apples contain far more of these naturally occurring plant compounds than juices – one review of studies suggests whole apples provide around 50-60 times more polyphenols than ready-prepared apple juice[86].

The higher fibre and polyphenol content of whole apples compared with apple juice may go some way to explaining why numerous studies show greater health benefits with eating whole fruit than with drinking juice[104].

Another reason for Public Health England's advice to limit fruit juice relates to its sugar content. When fruit is juiced, the cell walls in the fruit are broken down, releasing the natural sugars contained within them. Even though these sugars are natural, they are potentially more harmful to teeth than whole fruits, especially if juice is consumed frequently. This is one of the main reasons why dentists recommend limiting fruit juice, diluting it with water and having it with meals rather than between meals.

Meanwhile, like sugar, treacle, honey, syrups and nectars, the sugars in fruit juice are classified as 'free' sugars[105]. Following recommendations from the Scientific Advisory Committee on Nutrition in its report on Carbohydrates and Health[24], advice from Public Health England is for children over the age of 11 years and adults to limit free sugars to a maximum of 30g a day. A 150ml glass of clear apple juice contains around half of this (14.6g sugars). Younger children should have even less – a maximum of 19g a day for 4-6-year olds and no more than 24g a day for 7-10-year olds[106]. The sugars in whole fruit, including apples, are not defined as free sugars and so don't need to be specifically limited. Total sugars should, however, be limited to 90g a day – a large whole apple provides 17.6g total sugars or 20 percent of this.

Another key benefit to choosing whole apples over apple juice is that they're more likely to curb appetite, which can help with weight control. Drinks are consumed

more quickly and spend little time in the mouth, plus they are emptied faster from the stomach than whole foods. This can affect how full we feel – and the length of time we feel full for.

In particular, studies confirm that chewing improves satiety (that feeling of fullness) and can help to reduce food intake[19]. This is partly because chewing stimulates the release of gut hormones that help to indicate when we're feeling full, so we stop eating – a factor that's important for managing weight. This suggests whole apples, which are crunchy and need plenty of chewing, may be more likely than apple juice to help with appetite and weight control.

Indeed, studies seem to indicate this is the case. In one study, adults consumed 400-calories worth of fruit, either in the form of a juice or whole, before their lunch. The researchers found those who consumed the whole fruit ate a smaller quantity of food at lunchtime than those who had the juice. They also took in considerably fewer calories both at lunch and over the whole day. Those adults who were overweight or obese also reported they felt less hungry after the whole fruit compared with the juice[107].

Similar findings were seen in another study. Adults who ate 125 calories-worth of apple before lunch consumed 15 percent fewer calories in their meal than when they simply ate the main meal alone. When they ate apple sauce first (also providing 125 calories) they consumed six percent fewer calories than with just the main meal. But when they had 125 calories-worth of apple juice first, they actually consumed three percent more calories at their meal. The participants also reported less hunger after eating the whole apple compared with the apple sauce or juice[108].

What these studies show is that whole apples tend to be more filling than fruit juice – probably because they contain more fibre, take longer to eat, stay in the stomach for longer and stimulate the release of hormones that help indicate satiety.

**How to buy**

Look for firm fruits that are free from bruising. The colour of apples and the crispness of their flesh depends largely on the variety. As a rule, red skinned varieties such as Pink Lady® contain more anthocyanins – flavonoids that have been linked to many health benefits – than green or yellow skins.

Meanwhile, with so many apple varieties available, tastes can range from sweet to tart. Pink Lady® apples are one of the sweeter types of apple.

Pink Lady® has strict selection criteria, which means consumers can always be guaranteed a good-quality apple that's consistent for sweetness, colour and firmness, no matter where or when the apples are purchased. Pink Lady® apples bought between November and May come from Europe; those bought between

June and October come from the Southern Hemisphere. Wherever they're grown, the quality will be the same.

Whether or not to buy organic apples is purely a matter of personal choice. Whichever are purchased, apples offer an easy and tasty way to get the one extra portion of fruit that's needed to get Brits closer to achieving the recommended 5-a-day.

**Pink Lady® – An environmentally friendly choice**

Pink Lady® growers make a contractual commitment, through integrated fruit production charters. This cultivation method, which protects the environment, combines conventional practices with natural solutions from organic farming:

- The orchards are observed constantly, using software to monitor the trees, the soil's water requirements and the climate
- Biodiversity and a natural balance are maintained through grassy fields, hedges and birdhouses in the orchards
- Priority is given to natural methods of tree protection, such as using natural predators, for instance, ladybirds, against aphids, and the mating disruption pest management technique
- Any other measures, such as applying synthetic products, are kept to a strict minimum and used as a last resort and in case of absolute necessity.
- Some growers have opted for totally organic production, which currently represents 2% of Pink Lady® apple orchards. This type of agriculture is becoming more common.

## How to store

Apples have a longer shelf life than many other fruits, which means they're more likely to end up being eaten before they've had a chance to go past their best. This is great news for reducing food waste, which in turn, is good news for the environment. Ensuring apples get eaten also means both cash and nutrients don't get thrown away.

Pink Lady® apples can be kept for between 8 to 15 days at room temperature, although there's no reason why they can't be eaten after this time (apples have a 'best before' date, which is an indicator of quality rather than safety). Apples will last for longer periods in the refrigerator, too – but should be taken out an hour before eating to allow the flavours to fully develop.

There's no need to worry about nutrient levels dropping either. Storing apples appears to have little effect on their phytochemical content[42].

## How to eat

First and foremost, don't peel apples. Much of the fibre and phytochemicals are found in the skin so to maximise the potential health benefits, it's important to

include this part of the fruit[109,110,111]. Simply wash apples with water. Then it's simply a matter of choice whether to eat them alone or add to other dishes.

**Easy ways to enjoy Pink Lady® apples**

• Slice and add to cereal.

• Grate (including the skin) and stir into porridge for natural sweetness – add a little cinnamon, mixed spice, nutmeg or a drop of vanilla extract, too.

• Chop and add to salads – apples go especially well with chicken, cos lettuce, rocket, walnuts and stilton.

• Use in baked recipes such as muffins, apple cake or apple bread – cooked and pureed apples can also be used in place of some of the butter or margarine in cake recipes. As a rule, replace the fat in a cake with an equal amount of fruit purée and just one third of the oil or butter. For example, if a cake requires 150g butter, use 150g of apple purée plus 50g of butter. Using fruit instead of fat tends to work best in products like muffins and fruit-based cakes but won't work for biscuits as they need more fat to make them crisp and crunchy.

• Top rye crispbreads or oatcakes with low-fat cream cheese and slices of apple.

• Chop and mix with cottage cheese – it makes a great filling for jacket potatoes, sandwiches and wraps.

• Remove the core, cut into rings and top with almond or peanut butter or a little low-fat cream cheese. Add a few chopped nuts such as almonds for extra crunch.

• Cut into wedges and serve as an alternative to vegetable crudités with your favourite dip – Pink Lady® goes particularly well with hummus, tzatziki and cheese and chive dips.

• Chop into wedges, pop onto skewers and brush with a little honey – then cook over a barbecue or in a griddle pan until char lines appear and the apple has softened a little. Serve with a dollop of fat-free Greek yogurt.

• Remove the core, cut into wedges or rings and griddle the apple in a hot pan – perfect for serving with pork chops.

• Chop and add to homemade soups – it goes especially well with butternut squash and carrot.

• Chop into chunks and add to a casserole – it's especially good with pork or chicken.

• Chop into chunks or thin slices and use to decorate the top of a smoothie bowl.

• Cut into wedges and roast with vegetables such as carrots, parsnips, butternut squash and sweet potatoes.

• Remove the core, fill the middle with raisins and chopped almonds, then bake in the oven until hot – serve with low-fat ice cream, reduced-fat custard or a spoonful of fat-free plain yogurt.

• Add grated carrot to ready-made coleslaw – or make your own by shredding an apple and mixing it with grated carrots, finely sliced cabbage and red onion and a mix of low-fat yogurt and light mayonnaise.

• Pop a Pink Lady® onto a lollipop stick then drizzle with a little plain chocolate. Pop in the fridge to set and hey presto – an alternative to a toffee apple.

• Add apples to your cheeseboard.

• Simple enjoy as it is!

**Apple myths**

**MYTH #1 Apples are packed with sugar so should be avoided**
All fruit, including apples, contains natural sugars, mainly in the form of fructose. While health advice in the UK recommends limiting fruit juice, partly because of the sugar it contains, there's no need to limit whole fruit[4]. A large apple contains 17.6g sugar – that's a fifth of the maximum amount of sugar recommended in a day[23]. It's far better to limit sugary foods that also come packaged with a lot of calories and fat but little in the way of fibre. An apple is a great way to get closer towards reaching 5-a-day – something that seven out of 10 adults and nine out of 10 teenagers fail to achieve[9].

**MYTH #2 Apple pips are poisonous**
Apple pips do contain a natural compound that breaks down into substances that are toxic when chewed or digested. However, a large amount of pips would need to be eaten to suffer any ill effects. For example, it's estimated that someone weighing 64kg (10 stone) would need to eat between 189 to 5,292 apple pips to risk death. Furthermore, the seed coat of apple pips protects them from digestive enzymes, so most pass through the digestive system harmlessly. The reality is, if a few apple pips get eaten, there's no need to worry[112]!

**MYTH #3 I shouldn't eat fruit like apples if I have diabetes**
Achieving a healthy weight and eating a balanced diet that includes plenty of fruit and veg are important for preventing and managing diabetes. Anyone with diabetes should always follow the advice of their health care professional. However, as a rule,

everyone, including people with diabetes, should have five portions of fruit and veg a day. According to Diabetes UK, most people don't need to reduce their intake of fruit. Instead the focus should be on cutting down on foods with added sugars rather than fruit[113].

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