

of the sub-populations therein (AMAS-Aston Medical Adherence Study 2012)

The contribution of both macro (societal) and micro (individual) influences on behaviour continues below in our exploration of influences on other health behaviours (Chapter 5 🍷). Chapter 10 🍷 describes some of the efforts made to maximise adherence and, given evidence of generally moderate impact (see Haynes et al. 2008 for a Cochrane review and meta-analysis), some of the challenges faced.

Healthy diet

As described in the previous chapter, what we eat plays an important role in our long-term health and illness status, with diet having both direct and indirect links with illness. For example, fat intake is directly linked to various forms of heart disease by a range of physiological mechanisms, and indirectly related to disease by virtue of its effects on weight control and, in particular, obesity. The World Health Organization (WHO 2002a) states that low intake of fruit and vegetables as part of diet is responsible for over three million deaths a year, worldwide, from cancer or cardiovascular disease. The World Health Organization attributes 16 million (1 per cent) disability adjusted life years and 1.7 million (2.8 per cent) deaths worldwide to low fruit and vegetable intake, with the highest percentage being in the developed world including Europe and America, and the lowest attributable percentage being in high-mortality developing countries including many parts of Africa. Furthermore, one-third of cancer deaths are attributable, in part, to poor diet, particularly high intake of fats, salt and sugar and low levels of fibre (American Cancer Society 2012; see also Chapter 3 🍷). Given these reports, it is no surprise that government bodies, health ministers and medical authorities are producing guidelines on how to eat healthily, and that health researchers are working towards identifying factors that facilitate the adoption of these guidelines in our daily lives.

The health benefits of fruit and vegetable consumption

Fruit and vegetables contain, among other things, vitamins, folic acid, antioxidants (for example, beta carotene,

or lycopene in the red pigment of tomatoes, polyphenols in red grapes) and fibre, all of which are essential to a healthy body. They may also offer protection against diseases such as some forms of cancer, heart disease and stroke. For example, a recent large-scale review and meta-analysis of data from prospective studies found limited evidence of benefits of consumption for cancer risk, whereas all-cause mortality and cardiovascular disease risk was significantly reduced by higher fruit and vegetable intake (examining data from between 450,000 to over half a million study participants!) (Wang et al. 2014). Crucially these authors report a dose-response relationship whereby the reduced risk of cardiovascular mortality increase per additional portion of fruit and vegetable intake, up to a threshold of around 5 portions per day, after which no further reduced risk was observed. This finding is very important, given recent debates regarding 5, 7, or even 10 portions of fruit and vegetables a day – see ISSUES below.

Such large-scale evidence calls into question earlier reports of associations between fruit and vegetable intake and risk of some forms of cancer (e.g. Marmot et al. 2007). In 2005 Lock and colleagues estimated that worldwide, if people ate the recommended amounts of fruit and vegetables, the incidence of some forms of cancer, such as oesophageal and stomach cancers, would reduce significantly. Contrary to Wang's findings described above, however, a smaller, nationally representative study using the Health Survey for England dataset of over 65,000 adults aged over 35 (Oyebode et al. 2013) report a reduced cancer risk, as well as reduced all-cause and cardiovascular disease risk, with benefits gained from fruit and vegetable intake up to 7 portions a day. This study correctly controls for many risk factors such as age, alcohol consumption and levels of physical activity, but not, sadly, for smoking, a known risk for such mortality. It is, however, a nationally representative sample unlike many other databases, including the large 10 country European (EPIC) study, which recruited heavily from those accessing health-care services or systems and who are perhaps more likely to be health conscious.


It may also be that national variation exists depending on other lifestyle factors. For example, where fruit and vegetable intake is *combined* with a Mediterranean diet (e.g. low fat, fresh produce, more fish, less meat), there may be a stronger association between fruit and vegetable consumption and reduced disease risk. This was

found within the Greek cohort of the EPIC study (Trichopoulou et al. 2009), whereas the pooled data across ten countries showed a weak relationship (Wang et al. 2014).


Further evidence of the beneficial effects of high fruit and vegetable intake comes from a large **meta-analysis** of data involving 124,706 men and women where vegetarians had significantly lower cancer incidence and significantly lower rates of **ischaemic heart disease** mortality (Huang et al. 2012) than non-vegetarians. However, vegetarians also reported lower rates of smoking and lower levels of alcohol consumption than non-vegetarians, risk behaviours which were not always controlled for in the analyses. It is crucial that these and other health risk behaviours are considered when comparing sub-populations as important sample differences may exist which may account for some of the health differences claimed. Such results should not lead one to conclude that vegetarianism is protective against such diseases (Katz and Meller 2014).

Overall, however, the research evidence is fairly consistent in finding positive health benefits of fruit and vegetable intake (e.g. Katz and Meller 2014). The benefits found are attributed to the presence of **antioxidant** compounds known as ‘polyphenols’, such as the flavonoids (specifically flavonol), and in the case of tomatoes, lycopene (more being released when cooked than when eaten raw).

In relation to reduced coronary heart disease risk, the effects of a healthy diet high in fruit and vegetable intake

may also be indirect via effects on weight, (see Chapter 3  for discussion of obesity) and there remains a need for further controlled nutritional trials to ascertain what and how any benefits are achieved (Dauchet et al. 2009; Katz and Meller 2014).

Why do people not eat sufficient fruit and vegetables?

Much of the research carried out with regards to healthy eating focuses on young people and their food choices and eating behaviours, and, while this makes sense in relation to the growing prevalence of obesity (see Chapter 3 ) and in light of the fact that health behaviours set down in childhood can contribute towards adult health state, our society is an increasingly ageing one and therefore a greater focus on ‘healthy ageing’ is also required. A loss of appetite and reduced energy is often associated with growing older, but are not inevitable consequences and may reflect social factors (such as experiencing a loss of interest in food caused by eating alone), physical factors (access to shops, physical mobility) or personal factors such as lack of skill. It may be that older males, when widowed, face a particular challenge when having to shop and cook for themselves, as among much of the older population such roles have commonly been adopted by women. Hughes et al. (2004) carried out a questionnaire and interview study of 39 older men and found that only five (13 per cent) consumed five portions of fruit and vegetables a day, that 64 per cent consumed less energy than appropriate even when controlling for BMI, activity and age, and most had lower intake of essential nutrients than they should. Interestingly, this study relates food intake to the individuals’ cooking skills with perhaps unexpected findings. Those with good cooking skills reported higher vegetable intake but lower energy/calorie intake, whereas men with poorer cooking skills ate less vegetables but tended to eat more calorie-dense foods which, even if in line with calorie intake guidelines, is not necessarily a good thing as energy-dense foods are not always nutritious. The implications of such findings is that interventions should be quite practical, tying up cooking skills with both appropriately calorific and nutritious food (a new project for TV chef, Jamie Oliver, perhaps?!)

In spite of growing public awareness of the link between eating and health, fruit and vegetables tend not

meta-analysis

a review and re-analysis of pre-existing quantitative datasets that combines the analysis so as to provide large samples and high statistical power from which to draw reliable conclusions about specific effects.

ischaemic heart disease

a heart disease caused by a restriction of blood flow to the heart.

antioxidants

oxidation of low-density lipoprotein (LDL or ‘bad’) cholesterol has been shown to be important in the development of fatty deposits in the arteries; antioxidants are chemical properties (polyphenols) of some substances (e.g. red wine) thought to inhibit the process of oxidation.


IN THE SPOTLIGHT

Just how much fruit and veg is enough?!

In 1990 the WHO advised an intake of 400 grams of fruit and vegetables a day, with one portion equating to about 80 grams. This led to the UK launching its '5-a-day' campaign in 2003, which has also been embraced in other European countries, including France and Germany. Data from the Health Survey for England 2012 (The Health and Social Care Information Centre 2014) found that only 16 per cent of boys and 20 per cent of girls aged 5 to 15 were found to be eating at least 5 portions per day. While this is higher than in the 2001 and 2004 surveys, it is slightly lower than 2006 figures, and still reflects a small proportion of children. There is also substantial evidence that the majority of adults are also not following these recommendations, particularly young adults and males (e.g. Henderson et al. 2002; Baker and Wardle 2003) with only approximately 30 per cent reaching the recommended consumption.

Outside Europe, however, the campaign has differed, with higher guidelines existing, for example in Australia the 'GO for 2 + 5' campaign has, since 2005, provided recommendations currently for 2 servings of fruit (a serving being judged as 150 grams which is equivalent to your average apple) PLUS 5 servings of vegetables (with a serving being weighed in as 75 grams, about half a cup full of vegetables). It is notable that the Australian guidelines equate to 675 grams of daily intake, which in UK terms would be 8.5 portions, significantly more than the 5 portions currently recommended.

Do higher guidelines make for better consumption? Not if you consider that the 2007-08 National Health Survey in Australia revealed that 44 per cent of females and 54 per cent of males aged over 15 years were failing to meet the recommended intake for fruit, but even more worryingly, 90 per cent of females and 93 per cent of males failed to meet the recommended vegetable intake.

In the USA the '5 a day' approach was dropped in favour of a campaign simply promoting eating 'more' of both. Do health recommendations need to be precise and consistent in order to be taken seriously? In an article in the *Daily Mail* (2 April 2014), asking whether you should be eating 7 a day, two views of the new proposals were presented. The first is from a 'food writer' who argues that if we fail to meet the 5 portions currently recommended, there is no advantage in simply upping that to 7 without seriously addressing the barriers to behaviour change (costs, availability etc. and personal barriers, see Chapter 5 ). The second comment comes from a 'cancer expert', a doctor who fully supports the need for higher intakes in the battle against increased cancer and heart disease risk, and who in fact advocates cramming in as much fruit and vegetables as we can.

So, what do you do? As students being trained in reviewing an evidence base, I would advise behaviour based on current knowledge. As reviewed in this chapter, two large studies, one multinational (Wang et al. 2014), one UK based (Oyebode et al. 2013) support 5–7 portions a day as being sufficient to accrue health benefits over time, but with the caveat that other risk factors should not go ignored.

to be the food of choice of many young people. For example, the National Diet and Nutrition Survey (Food Standards Agency 2009) found that the foods most frequently consumed by British young people (aged 4 to 18 years) were white bread, savoury snacks (e.g. crisps), biscuits, potatoes and confectionery, although an encouraging trend was seen in terms of increased fruit intake compared to previous years. Although the average

vitamin intake was not deficient, intake of some minerals was low. These food preferences can in part be understood by the findings of another survey of British young people (Haste 2004), which found that children gave 'It tastes good' (67 per cent) and 'It fills me up' (43 per cent) as the top two reasons for their favourite food choice, above 'Because it is healthy' (22 per cent) and 'It gives me energy' (17 per cent).

Unfortunately, tasting ‘good’ often appears to correlate with sugar and fat content rather than with healthy food, and preconceptions exist about healthy food that can work against a person making healthy food choices. For example, 37 per cent of Haste’s sample agreed with the statement ‘Healthy food usually doesn’t taste as good as unhealthy food’. Where do these preferences and perceptions come from?

Food preferences

Whilst food preferences have a biological basis, they are also significantly determined by social and cultural factors (Pfeifer 2009). Parents play a major role in setting down patterns of eating, food choices and leisure activities inasmuch as they develop the rules and guidelines as to what is considered appropriate behaviour. Parental behaviours at mealtimes have been variously associated with child eating behaviour, for example, parental permissiveness was associated with less healthy eating behaviour among adolescents and young adults (Bourdeaudhuij 1997; Bourdeaudhuij and van Oost 1998), and child-centred feeding practices including

reasoning and praising related positively to fruit and vegetable intake in contrast to parent-centred feeding practices including warning or physically struggling to get a child to eat these food types (Vereecken et al. 2010). Food preferences are generally learned through socialisation within the family, with the food provided by parents to their children often setting the child’s future preferences for:

- *cooking methods*: e.g. home-cooked/fresh vs. ready-made/processed;
- *products*: e.g. high-fat vs. low-fat, organic vs. non-organic;
- *tastes*: e.g. seasoned vs. bland, sweet vs. sour;
- *textures*: e.g. soft–crunchy, tender–chewy;
- *food components*: e.g. red/white meat, vegetables, fruit, grains, pulses and carbohydrates.

Various interventions have targeted the fruit and vegetable intake of young people, such as the Food Dudes programme developed in North Wales, which targets pre-school and primary-school children in the UK, Ireland and elsewhere in Europe (Tapper et al. 2003; Horne et al. 2004, 2009). This programme draws on established learning theory techniques of increased taste exposure to fruit and vegetables, modelling of healthy behaviour through cartoon youth characters (see Photo 4.1), and reinforcement by means of child-friendly rewards (e.g. stickers, crayons) for eating the fruit and vegetables provided at snack and meal times (Lowe et al. 2004). Long-term effectiveness of a peer-modelling and rewards-based intervention on the fruit and vegetable consumption of children was found (see Figure 4.1), with particular gains among those children who ate less fruit and vegetables at the study outset (Horne et al. 2009). These findings have also been replicated in the USA (Wengreen et al. 2013) where biophysical measurement methods were utilised alongside self-report measures to demonstrate effects of increased fruit and vegetable intake. Evidence suggests that simply increasing exposure to, or availability of, healthy food options, is insufficient: for example, a randomised controlled trial of having fruit ‘tuck shops’ in primary schools did not find an increase in fruit consumption (Moore et al. 2000; Moore 2001). In addition, there is reasonably strong evidence that the presence of factual knowledge that healthy eating is important, and even knowing what constitutes healthy eating, does not



Photo 4.1 ‘We are what we eat?’ The importance of providing positive norms for healthy eating in children

Source: Bangor University, School of Psychology.