

**We all know that what we eat can affect our health. New research, however, shows that there may be a specific link between diet and pain. Pain specialist Dr Rae Frances Bell tells us more, and outlines steps you can take to improve your diet as part of your pain management regime**

It's very important for people with chronic pain to maintain a healthy, balanced diet. There are several reasons for this. Firstly, the nervous system has the capacity to dampen pain. Most people have heard of the body's own morphine-like substances called endorphins. In order to be able to function optimally, the nervous system requires specific nutrients such as essential amino acids. One example is tryptophan, which is a building block in the synthesis of the neurotransmitter serotonin which is very important in the body's own pain-dampening systems.<sup>1</sup> Foodstuffs such as nuts/seeds, fish, eggs, beans, oats, chicken and turkey contain high levels of tryptophan.

On the most basic level, the nervous system needs nutrients. Certain vitamin deficiencies can cause pain problems. For example, vitamin B12 deficiency can cause very unpleasant peripheral polyneuropathy, which is nerve pain in both feet and also sometimes in the hands.<sup>2</sup> Vitamin D deficiency can cause musculoskeletal pain, as can vitamin C deficiency.<sup>3 4</sup>

## **Omega-3 and Omega-6**

The World Health Organisation published a report in 2003 which described how there has been a global shift in diet resulting from different factors such as industrialisation and market globalisation. Our diet has changed from being predominantly plant-based to more high-energy density and processed foods, including a substantial increase in the intake of saturated fats and sugars. One factor the report focused on was the balance between dietary intake of omega-6 fatty acids and omega-3 fatty acids. The 'ideal' ratio between these fatty acids is thought to be 1:1, while ratios under 5:1 have been associated with reduced risk for heart disease, cancer and auto-immune inflammatory conditions.<sup>5 6 7</sup>

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<sup>1</sup> Bardin L. The complex role of serotonin and 5-HT receptors in chronic pain. *Behavioural Pharmacology* 2011; 22(5-6):390-404.

<sup>2</sup> Stabler SP. Clinical practice. Vitamin B12 deficiency. *New England Journal of Medicine* 2013;368(2):149-60.

<sup>3</sup> Mascarenhas R et al. Hypovitaminosis D-induced pain. *Nutrition Reviews* 2004;62(9):354-9.

<sup>4</sup> Smith A et al. Scurvy in the developed world. *CMAJ* 2011; 183 (11): E752.®E755.

<sup>5</sup> Simopoulos AP. Importance of the ratio of omega-6/omega-3 essential fatty acids:evolutionary aspects. *World Review of Nutrition and Diet* 2003;92:1-22.

<sup>6</sup> Simopoulos AP. Omega-6/omega-3 essential fatty acid ratio and chronic diseases. *Food Reviews International* 2004;20(1):77-90.

<sup>7</sup> Russo GL. Dietary n-6 and n-3 polyunsaturated fatty acids: from biochemistry to clinical implications in cardiovascular prevention. *Biochemical Pharmacology* 2009;77(6):937-46.

However, in the average American diet today, the intake of omega-6 is around 15 to 25 times the intake of omega-3.<sup>8</sup> Foods containing relatively high levels of omega-3 are cold water oily fish such as mackerel, herring and salmon, fish oil, flax seed and flax seed oil; while omega-6 is plentiful in poultry, and in many vegetable oils, especially soybean oil. Soybean oil is used in the production of fast food and snacks and I think this widespread use has particularly contributed to high levels of omega-6 in our diet.

Omega-6 has been linked to inflammation, which is something we need to aid healing in our body. But an exaggerated inflammatory response creates its own problems. Omega-3 has anti-inflammatory effects. Research has found that increased dietary intake of omega-3 reduces joint pain, morning stiffness, number of painful joints and consumption of non-steroidal anti-inflammatory drugs in patients with rheumatoid arthritis.<sup>9</sup> The balance between these fatty acids in our diet is thought to be important. So one thing for pain patients to pay attention to with regard to diet is to ensure they have a sufficient intake of omega-3 while avoiding excessive intake of omega-6.

A number of foods contain substances which have anti-inflammatory properties, just like non-steroidal anti-inflammatory drugs. For example, in virgin olive oil, there's a compound called oleocanthal, which has been shown to have anti-inflammatory and pain relieving effects similar to ibuprofen.<sup>10 11</sup> This is really interesting because non-steroidal anti-inflammatory drugs can have a lot of side effects. If we can achieve some anti-inflammatory and pain-relieving effects through eating healthily that would be ideal.

## **Antioxidants**

Antioxidants have anti-inflammatory effects and are found in many foodstuffs. Resveratrol is an antioxidant which is formed in certain plants when they're under attack by bacteria or insects. It's found in the skin of red grapes, and in red wine and grape juice, and it has powerful anti-inflammatory and neuroprotective effects.<sup>12 13</sup> Antioxidants called anthocyanins are found in the reddish-blue pigments in blueberry skins and cherries and in animal studies have been shown to reduce inflammatory pain.<sup>14 15</sup>

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<sup>8</sup> Blasbalg TL et al. Changes in consumption of omega-3 and omega-6 fatty acids in the United States during the 20th century. *American Journal of Clinical Nutrition* 2011;93:950-62.

<sup>9</sup> Goldberg RJ et al. A meta-analysis of the analgesic effects of omega-3 polyunsaturated fatty acid supplementation for inflammatory joint pain. *Pain* 2007;129(1-2):210-212.

<sup>10</sup> Beauchamp GK et al. Phytochemistry: ibuprofen-like activity in extra-virgin olive oil. *Nature* 2005;437(7055):45-46.

<sup>11</sup> Segura-Carretero A et al. Current disease-targets for oleocanthal as promising natural therapeutic agent. *Int J Mol Sci* 2018; 19(10):2899.

<sup>12</sup> Bertelli A et al. Analgesic resveratrol? *Antioxidants and Redox Signaling* 2008; 10(3):403-404.

<sup>13</sup> Rauf A et al. A comprehensive review of the health perspectives of resveratrol. *Food Funct* 2017; 8(12): 4284-4305.

<sup>14</sup> Tall J M. Tart cherry anthocyanins suppress inflammation-induced pain behavior in rats. *Behavioural Brain Research* 2004;153(1):181-188.

<sup>15</sup> Lee Y M et al. Dietary anthocyanins against obesity and inflammation. *Nutrients* 2017; 9(10): 1089.

Unfortunately, there is a lot of hype in the media about antioxidants, with multiple advertisements telling us to buy antioxidant products. You actually don't need a huge intake and the best way to get antioxidants is through your diet, not through pills.

I think most people know whether their diet is healthy or not. If we're busy and just snacking instead of eating regular meals, it's not good enough. We need to be getting vitamins; we need to be eating more fish, less red meat and lots of fresh vegetables, especially green leafy and brightly coloured vegetables. It's the colour pigments which contain the antioxidants, so if you think of a colourful, Mediterranean kind of diet then you're on the right track.

### **Foods to limit**

Some foodstuffs can increase pain. Professor Guy Simonnet and colleagues in Bordeaux have done interesting scientific research on *polyamines*.<sup>16</sup> Polyamines are important for cell growth and we obtain most of our polyamines through the diet. Polyamines upregulate activity in a receptor in the nervous system which is involved in amplifying pain and a polyamine deficient diet has been shown in a rat study to reduce pain hypersensitivity. Oranges and orange juice contain very high levels of polyamines. That doesn't mean you should stop drinking orange juice, it just means you should probably think twice before drinking large quantities on a daily basis. Peanuts and potato crisps also contain high levels of polyamines.

Some pain-relieving medications contain caffeine because it interacts with analgesic drugs and can increase the effect of paracetamol and aspirin. But caffeine has other attributes that are actually harmful and regular moderate to high intake of coffee or other drinks containing caffeine can cause problems. Caffeine blocks the effects of the body's own relaxatory neurotransmitter *adenosine*. Everyone knows that coffee can disturb sleep. If you have chronic pain and sleep poorly, you will feel more pain. If coffee is consumed on a regular basis, it can also increase the risk of developing a chronic daily headache.<sup>17</sup>

High levels of caffeine are linked to osteoporosis, so if you drink more than four cups of coffee a day your risk of developing osteoporosis increases.<sup>18 19</sup> This is also the case for other caffeinated beverages such as cola and "energy" drinks. In addition to flavouring, sugar or sugar replacement and water, cola contains phosphoric acid and caffeine. The taste might be nice, but there is nothing else positive about cola. A regular high intake of cola or "energy" beverages can cause sleep problems and increase the risk of osteoporosis in the same way as coffee due to the high caffeine levels.

### **What to eat**

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<sup>16</sup> Rivat C et al. Polyamine deficient diet to relieve pain hypersensitivity. *Pain* 2008;137(1):125-137.

<sup>17</sup> Sawynok J. Caffeine and pain. *Pain* 2011; 152:726-729.

<sup>18</sup> Harris SS et al. Caffeine and bone loss in healthy post-menopausal women. *American Journal of Clinical Nutrition* 1994; 60(4):573-8.

<sup>19</sup> Dai Z et al. Coffee and tea drinking in relation to risk of hip fracture in the Singapore Chinese Health study. *Bone* 2018 112: 51-57.

At our pain clinic we regularly ask our patients what they eat. We started doing this more than 20 years ago and quickly discovered that many of them had a poor or sub-optimal diet. There can be different reasons for this - some pain patients suffer depression and have reduced appetite, or they simply don't feel up to preparing meals. Most are unaware that diet plays a role in pain and that it is especially important for chronic pain patients to have a healthy, balanced diet.<sup>20</sup> By bearing in mind some of these simple principles you may find ways to make the food you eat an important part of your pain management plan:

- Pain patients should include foods rich in omega-3 in their diet and be careful with regard to foods rich in omega-6. Swapping dietary vegetable oils high in Omega-6 fatty acids (such as soybean, safflower or sunflower oils) with oils high in Omega-3 fatty acids (such as rapeseed or flax oils) or monounsaturated oils such as olive oil will help optimise the Omega-6/Omega-3 fatty acid ratio, as will eating more fish and less red meat.<sup>21</sup> Think about getting antioxidants through eating colourful meals with fresh vegetables, fruit and berries. Cut out all kinds of cola or "energy" beverages. Reduce your daily consumption of coffee. Don't drink coffee (unless it is decaffeinated) after midday if you have sleep problems.
- Eat regular meals with no more than 4 hours interval- For example, 3 main meals + two light snacks and don't skip breakfast. Eating regularly is especially important for patients with chronic headache.
- If you feel you need to lose weight, ask your GP for a consultation with a dietician. They will probably advise you to cut down on saturated fats, sugars, processed foods and snacks, and to eat more fresh vegetables and protein.
- Get enough vitamins through your diet. Vitamin B12 or *cobalamin* is abundant in shellfish, fish, egg yolks, beef, lamb and cheese.
- Nearly a thousand people over 65 took part in a study to see if there was any connection between the amount of vitamin D they had in their blood stream and their experience of back pain. There was no relationship in men, but women who had less than a third the levels of vitamin D considered healthy by most experts<sup>22</sup> experienced significant back pain, suggesting that women may be more vulnerable to vitamin D deficiency-related pain.<sup>23</sup> A recent systematic review found a high

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<sup>20</sup> Bell RF et al. Food, pain and drugs: does it matter what pain patients eat? *Pain* 2012; 153(10):1993-6.

<sup>21</sup> Simopoulos AP. An increase in the Omega-6/Omega-3 fatty acid ratio increases the risk for obesity. *Nutrients* 2016; 8(3): 128).

<sup>22</sup> Holick MF et al. Vitamin D deficiency: a worldwide problem with health consequences. *Am J Clin Nutr* 2008;87(4):1080S-6S.

<sup>23</sup> Hicks GE. Associations between Vitamin D status and pain in older adults: the Invecchiare in Chianti study. *Journal of the American Geriatrics Society* 2008;56(5):785-91.

prevalence of Vitamin D deficiency in patients with low back pain<sup>24</sup>. We get vitamin D from sunlight, so in the winter most of us need a supplement in the form of cod liver oil or vitamin D tablets. Margarine and milk products are often fortified with vitamin D.

- Vitamin C is an antioxidant with anti-inflammatory effects. As mentioned above, Vitamin C deficiency can cause musculoskeletal pain. In addition, research seems to suggest that a deficiency of Vitamin C may be a significant factor in the pain experienced by people with post-herpetic neuralgia.<sup>2526</sup> If you have post-herpetic neuralgia, maintaining good levels of vitamin C in your diet could possibly help you with your pain. Vitamin C is found in fruit and vegetables such as strawberries, oranges, kiwi, broccoli, and red peppers.

For dietary advice specific to your needs we recommend you consult your GP, pain specialist or a qualified dietitian. For more information visit [bda.uk.com/publications/index.html](http://bda.uk.com/publications/index.html).

Dr Bell also discussed this issue in programme 4 of *Airing Pain*, which can be found at <http://painconcern.org.uk/airing-pain-programme-4-diet-cbt-and-mindfulness/>.

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<sup>24</sup> Bansal D et al. High prevalence of hypovitaminosis D in patients with low back pain: evidence from meta-analysis. *Pain Physician* 2018;21(4):E389-E399.

<sup>25</sup> Chen JY et al. Plasma vitamin C is lower in postherpetic neuralgia patients and administration of vitamin C reduces spontaneous pain but not brush-evoked pain. *Clinical Journal of Pain* 2009; 25(7):562-9.

<sup>26</sup> Kim MS, Kim DJ, Na CH, Shin BS. A study of intravenous administration of vitamin C in the treatment of acute herpetic pain and postherpetic neuralgia. *Ann Dermatol* 2016;28(6):677-683.