

A young girl with blonde hair is looking at two glasses of water. The image is partially obscured by a teal circular graphic on the right side of the page.

Wise up  
on water!

Kids run on  
water too!

## Introduction

Children establish drinking patterns early in childhood, so it is vital to teach them about the importance of good hydration at an early age. Good hydration benefits children's health now and in the future.

Children can easily become dehydrated during hot weather and as a result of physical activity because they have:

- a higher surface area to body mass ratio compared to adults, so are more likely to lose water by evaporation
- less developed sweating ability and kidneys function<sup>1</sup>
- less sensitive thirst response<sup>2</sup>

Water is one of the most important basic nutrients required by the body, together with carbohydrate, fat, protein, vitamins and minerals.<sup>3</sup> Unfortunately, many children do not drink adequately for their age or activity level.<sup>4</sup> Some drink significantly less during the school day than at the weekend.<sup>5</sup>

In order to keep properly hydrated throughout the day, children need access to water at school. The promotion of good hydration is included within the government's Food in Schools programme,<sup>6</sup> which supports the National Healthy Schools Standard.<sup>7</sup> It advises that good quality drinking water should be available to pupils throughout the day and not from taps or drinking fountains located in toilets areas.<sup>8</sup>

## Weight

Obesity in children increased significantly between 1995 and 2002 and continues to rise. In 2002, 22 per cent of boys and 28 per cent of girls were either overweight or obese.<sup>9</sup> The high sugar content of soft drinks has been identified as one of the factors involved in childhood obesity.<sup>10</sup> Replacing soft drinks in the diet with water (which has no calories) can help with weight control.<sup>11</sup>

Fifteen per cent of preschool children consume just under half their recommended daily energy intake in the form of sugary drinks. These drinks are nutritionally poor and can reduce children's appetite so that they miss eating valuable nutrients at mealtimes.<sup>12</sup> In addition, sugary drinks may not quench thirst as much as water, which encourages children to drink more of them.<sup>13</sup>

One theory linking mild dehydration to obesity suggests that low fluid intake may stimulate a preference for a high fat diet. Of all the nutrients, fat generates the most metabolic water when it is broken down by the body. By providing maximum metabolic water, a high fat diet could be part of a compensatory mechanism to deal with perpetually low water intakes.<sup>14</sup>

Obesity in childhood is a risk factor for other serious diseases such as type 2 diabetes,<sup>15</sup> heart disease and increases the chance of



### **Good hydration helps children to:**

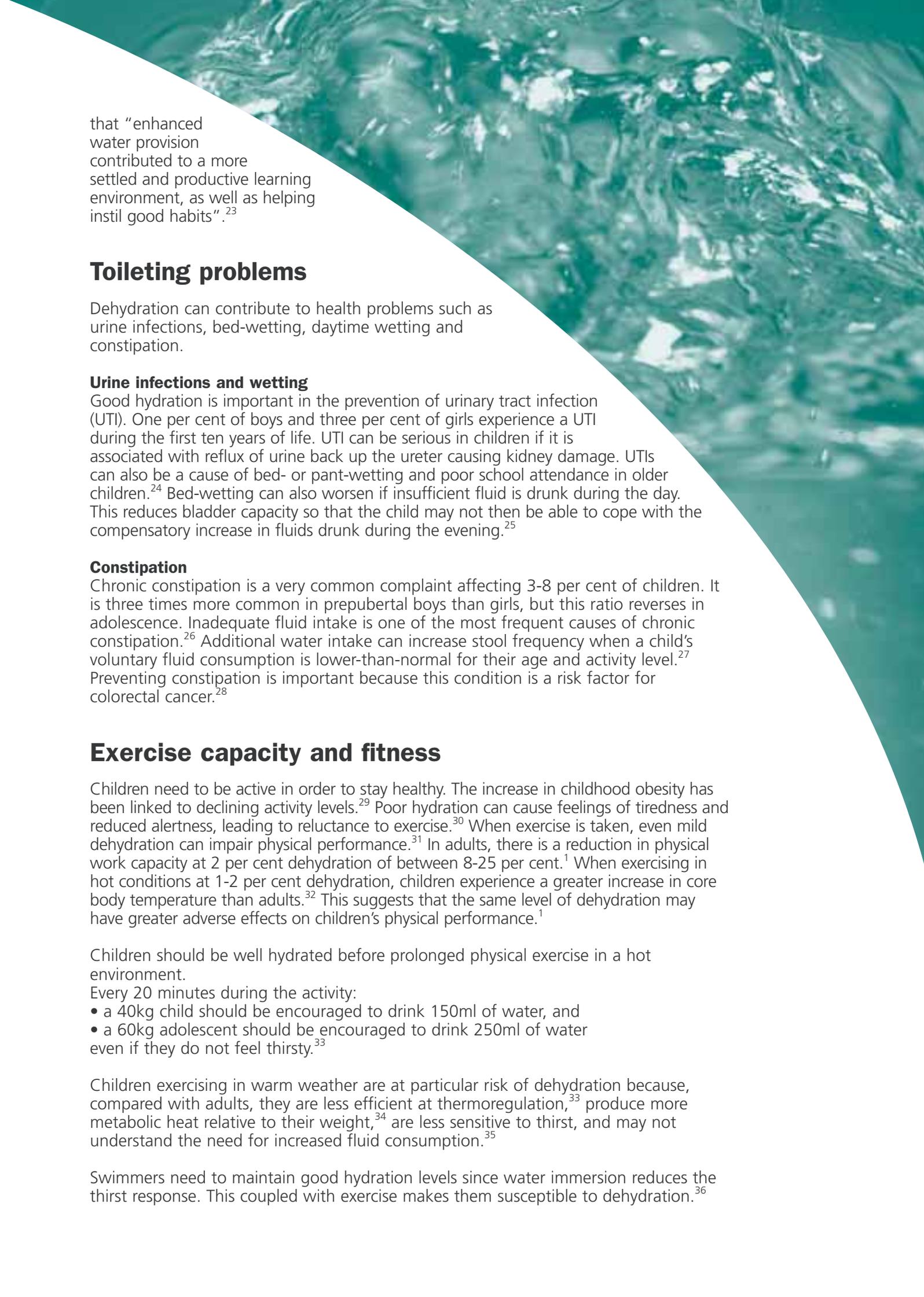
maintain a healthy...	<b>W</b> eight
improve...	<b>A</b> ttention and concentration
resolve...	<b>T</b> oileting problems such as wetting and constipation
increase...	<b>E</b> xercise capacity and fitness levels
reduce the...	<b>R</b> isk of chronic disease

being overweight or obese as an adult.<sup>16</sup> The White Paper *Choosing Health: making healthier choices easier* sets out a broad strategy to tackle obesity, with the specific target to halt the increase in obesity among children under 11 by 2010.<sup>17</sup>

## **Attention and concentration**

Poor hydration adversely affects a child's mental performance and learning ability. Symptoms of mild dehydration include light-headedness, dizziness, headaches and tiredness,<sup>18</sup> as well as reduced alertness and ability to concentrate.<sup>19,20</sup> Once thirst is felt, mental performance including memory, attention and concentration can decrease by about 10 per cent. Mental performance deteriorates progressively as the degree of dehydration increases.<sup>19,21,22</sup> Thirst is usually felt when dehydration reaches 0.8-2 per cent loss of body weight due to water loss.<sup>18</sup> For a 10-year-old child weighing 30kg this is the equivalent to one or two large glasses of water (300ml each).

Water consumption also has an immediate "alerting" and "revitalising" effect.<sup>19</sup> In schools taking part in the Food in Schools water provision pilot project, teachers reported



that “enhanced water provision contributed to a more settled and productive learning environment, as well as helping instil good habits”.<sup>23</sup>

## Toileting problems

Dehydration can contribute to health problems such as urine infections, bed-wetting, daytime wetting and constipation.

### Urine infections and wetting

Good hydration is important in the prevention of urinary tract infection (UTI). One per cent of boys and three per cent of girls experience a UTI during the first ten years of life. UTI can be serious in children if it is associated with reflux of urine back up the ureter causing kidney damage. UTIs can also be a cause of bed- or pant-wetting and poor school attendance in older children.<sup>24</sup> Bed-wetting can also worsen if insufficient fluid is drunk during the day. This reduces bladder capacity so that the child may not then be able to cope with the compensatory increase in fluids drunk during the evening.<sup>25</sup>

### Constipation

Chronic constipation is a very common complaint affecting 3-8 per cent of children. It is three times more common in prepubertal boys than girls, but this ratio reverses in adolescence. Inadequate fluid intake is one of the most frequent causes of chronic constipation.<sup>26</sup> Additional water intake can increase stool frequency when a child's voluntary fluid consumption is lower-than-normal for their age and activity level.<sup>27</sup> Preventing constipation is important because this condition is a risk factor for colorectal cancer.<sup>28</sup>

## Exercise capacity and fitness

Children need to be active in order to stay healthy. The increase in childhood obesity has been linked to declining activity levels.<sup>29</sup> Poor hydration can cause feelings of tiredness and reduced alertness, leading to reluctance to exercise.<sup>30</sup> When exercise is taken, even mild dehydration can impair physical performance.<sup>31</sup> In adults, there is a reduction in physical work capacity at 2 per cent dehydration of between 8-25 per cent.<sup>1</sup> When exercising in hot conditions at 1-2 per cent dehydration, children experience a greater increase in core body temperature than adults.<sup>32</sup> This suggests that the same level of dehydration may have greater adverse effects on children's physical performance.<sup>1</sup>

Children should be well hydrated before prolonged physical exercise in a hot environment.

Every 20 minutes during the activity:

- a 40kg child should be encouraged to drink 150ml of water, and
- a 60kg adolescent should be encouraged to drink 250ml of water even if they do not feel thirsty.<sup>33</sup>

Children exercising in warm weather are at particular risk of dehydration because, compared with adults, they are less efficient at thermoregulation,<sup>33</sup> produce more metabolic heat relative to their weight,<sup>34</sup> are less sensitive to thirst, and may not understand the need for increased fluid consumption.<sup>35</sup>

Swimmers need to maintain good hydration levels since water immersion reduces the thirst response. This coupled with exercise makes them susceptible to dehydration.<sup>36</sup>

## Risk of chronic disease

Drinking enough water can help to protect the body against certain chronic diseases. Individuals who maintain good hydration levels have been shown to have a reduced risk of developing the following diseases:

- breast,<sup>37</sup> colorectal,<sup>38</sup> urinary tract cancer.<sup>39,40</sup>
- cardiovascular disease<sup>41</sup>
- gallstones<sup>42</sup>
- kidney and bladder stones<sup>43,44</sup>

## Other health benefits of water for children

### Oral health

Having a dry mouth is one of the early signs of dehydration.<sup>18</sup> Mild dehydration may be a risk factor for dental disease because it impairs saliva production. Saliva is essential for good oral health:

- it neutralizes the acid created by the bacteria which cause tooth decay
- lubricates oral membranes
- contains minerals that enable tooth repair, and
- contains antibacterial agents that inhibit the growth of oral bacteria and help prevent gum disease.<sup>45</sup>

### Skin

Being well hydrated keeps skin looking healthy. The skin acts as a water reservoir and participates in fluid regulation for the whole body.<sup>46</sup> Mild dehydration causes skin to appear flushed, dry and loose.<sup>18,47</sup>

## Water requirements

Children's water requirements vary with age. As milk intake decreases, water obtained from drinks becomes increasingly important. There are no agreed recommended daily intake levels for water in the UK, but recommendations from the US National Academies Food and Nutrition Board<sup>1</sup> suggest that:

- 1-3 year olds should drink 0.9 litres per day
- 4-8 year olds should drink 1.2 litres per day and
- 9-13 year old girls should drink 1.6 litres per day, and boys should drink 1.8 litres per day
- 14-18 year old girls should drink 1.8 litres per day, and boys should drink 2.6 litres per day

Water intake should be higher in warm weather or when the child is exercising.

### Further information can be obtained from:

Water UK, Water for Health, Ask about ...  
<http://www.water.org.uk/home/resources-and-links/water-for-health/ask-about>  
Written by Hilary J Forrester, Independent Researcher and Senior Policy Executive, Science & Education, BMA.  
Cover photograph kindly supplied by United Utilities

- 1 Dietary Reference Intakes for Water, Potassium, Sodium, Chloride and Sulfate (2004) Institute of Medicine of the National Academies. Washington DC: The National Academies Press. <http://books.nap.edu/catalog/10925.html>
- 2 Kenney WL, Chiu P. Influence of age on thirst and fluid intake. *Medicine and Science in Sports and Exercise*. 2001;33:1524-32
- 3 Food Science, Nutrition and Health. Ed BA Fox and AG Cameron. 6th Edn. London: Edward Arnold 1995
- 4 Rogers J. Fluid intake advice for children with continence problems. Some issues explored. ERIC
- 5 Rugg-Gunn A J, Hackett A F, Appleton D R, Eastoe J E, Dowthwaite L, Wright W G. The water intake of 405 Northumbrian adolescents aged 12-14 years. *British Dental Journal* 1987;162:335-340
- 6 Food in schools programme. Department of Health and Department of Education and Skills. <http://www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCareTopics/FoodInSchools>
- 7 National Healthy Schools Standard Initiative: <http://www.wiredforhealth.gov.uk>
- 8 Food in Schools Data Centre: <http://foodinschools.datacenta.uk.net>
- 9 Health Survey for England 2002: Summary of Key findings: <http://www.official-documents.co.uk/document/deps/doh/survey02/summ03.htm>
- 10 Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *The Lancet* 2001;357:505-8
- 11 Levine B. Role of liquid intake in childhood obesity and related diseases. *Current Concepts & Perspectives in Nutrition* 1996;8(2)
- 12 Petter LPM, Hourihane J O'B and Rolles CJ. Is water out of vogue? A survey of drinking habits of 2-7 year olds *Archives of Disease in Childhood* 1995;72:137-40
- 13 Rolls BJ, Kim S, Fedoroff IC. Effects of drinks sweetened with sucrose or aspartame on hunger, thirst and food intake in men. *Physiology and behaviour* 1990;48:19-26
- 14 Stookey JD. Another look at fuel + O2 -> CO2 + H2O. Developing a water-oriented perspective. *Medical Hypotheses* 1999;52:285-290
- 15 Drake AJ, Smith A, Betts PR, Crowne EC, Shield JPG. Type 2 diabetes in obese white children. *Archives of Disease in Childhood* 2002;86:207-8
- 16 Must A and Strauss RS. Risks and consequences of childhood and adolescent obesity. *International Journal of Obesity* 1999 23: Suppl-11
- 17 Choosing Health: making healthier choices easier, Public Health White Paper, Department of Health, CM 6374. 2004. <http://www.dh.gov.uk/assetRoot/04/09/47/58/04094758.pdf>
- 18 Kleiner SM. Water: An essential but overlooked nutrient. *Journal of the American Dietetic Association* 1999;99:201-7
- 19 Rogers PJ, Kainth A, Smit HJ. A drink of water can improve or impair mental performance depending on small differences in thirst. *Appetite* 2001;36:57-58
- 20 Sherriffs SM, unpublished data, as quoted in Maughan RJ. Impact of mild dehydration on wellness and on exercise performance. *European Journal of Clinical Nutrition* 2003;57 (Suppl 2):S19-23
- 21 Gopinathan PM, Pichan G, Sharma VM. Role of dehydration in heat stress-induced variations in mental performance. *Archives of Environmental Health* 1988;43:15-17
- 22 Sharma VM, Sridharan K, Pichan G, Panwar MR. Influence of heat-stress induced dehydration on mental functions. *Ergonomics* 1986;29:791-99
- 23 Food in Schools: Water Provision Toolkit. <http://foodinschools.datacenta.uk.net/home.asp?idTopic=0&idPage=1>
- 24 The National Kidney Research Fund. What I tell parents about... UTIs and reflux in children. Reproduced from the *British Journal of Renal Medicine*, Autumn 1999, Volume 4, Number 3, Hayward Medical Communications 1999
- 25 Water is cool in school. FAQ: What's the link between wetting problems and drinking water? <http://www.wateriscoolinschool.org.uk/faq.html>
- 26 Arnaud MJ. Mild dehydration: a risk factor of constipation? *European Journal of Clinical Nutrition* 2003;57(Suppl 2):S88-95
- 27 Young RJ, Beerman LE and Vanderhoof. Increasing oral fluid in chronic constipation in children. *Gastroenterology Nursing* 1998;21:156-61
- 28 Sonnenberg A, Muller AD. Constipation and cathartics as risk factors of colorectal cancer: a meta-analysis. *Pharmacology* 1993;47(Suppl 1):224-33
- 29 Livingstone MB, Robson PJ, Wallace JM, McKinley MC. How active are we? Levels of routine physical activity in children and adults. *Proceedings of the Nutrition Society*. 2003;62:681-701
- 30 Maughan RJ. Impact of mild dehydration on wellness and on exercise performance. *European Journal of Clinical Nutrition* 2003;57 (Suppl 2):S19-23
- 31 Barr SI. Effects of dehydration on exercise performance. *Canadian Journal of Applied Physiology* 1999;24:164-72
- 32 Bar-Or O, Dotan R, Inbar O, Rotshtein A and Zonder H. Voluntary hypohydration in 10 to 12 year-old boys. *Journal of Applied Physiology: Respiratory, Environmental & Exercise Physiology* 1980;48:104-8
- 33 American Academy of Paediatrics Committee on Sports Medicine position paper: climatic heat stress and the exercising child. *Pediatrics* 1982;69:808-809
- 34 American Academy of Paediatrics. Policy Statement. Climatic Heat Stress and the exercising child and adolescent. Committee on Sports Medicine and Fitness. *Paediatrics* 2000;106:158-159
- 35 Maughan RJ. Impact of mild dehydration on wellness and on exercise performance. *European Journal of Clinical Nutrition* 2003;57 (Suppl 2):S19-23
- 36 Convertino VA, Armstrong LE, Copple EF, Mack GW, Swaka MN, Senay LC Jr, Sherman WM. American College of Sports Medicine, Exercise and fluid replacement. *Medicine & Science in Sports and Exercise* 1996;28:i-vii
- 37 Stookey JD, Belderson PE, Russell JM, Barker ME. Correspondence re: J. Shannon et al. Relationship of food groups and water intake to colon cancer risk. *Cancer Epidemiology, Biomarkers & Prevention*. 1997;6:657-658
- 38 Shannon J, White E, Shattuck AL, Potter JD. Relationship of food groups and water intake to colon cancer risk. *Cancer Epidemiology, Biomarkers & Prev*. 1996;5:495-502
- 39 Bitterman WA, Farhadian H, Abu S-C, Lerner D, Amoun H, Krapp D, Makov UK. Environmental and nutritional factors significantly associated with cancer of the urinary tract among different ethnic groups. *Urologic Clinics of North America* 1991;18:501-8
- 40 Wilkens LR, Kadir MM, Kolonel LN, Nomura AM, Hankin JH. Risk factors for lower urinary tract cancer: the role of total fluid consumption, nitrites and nitrosamines, and selected foods. *Cancer Epidemiology, Biomarkers & Prevention* 1996;5:161-166
- 41 Chan J, Knutsen SF, Blix GG, Lee JW, Fraser GE. Water, other fluids, and fatal coronary heart disease. *American Journal of Epidemiology* 2002;155:827-33
- 42 Math MV, Rampal PM, Faure XR and Delmont JP. Gallbladder emptying after drinking water and its possible role in prevention of gallstone formation. *Singapore Medical Journal* 1986;27:531-2
- 43 Curhan GC, Willett WC, Rimm EB and Stampfer MJ. A prospective study of dietary calcium and other nutrients and the risk of symptomatic kidney stones. *New England Journal of Medicine* 1993;328:833-38
- 44 Siener R and Hesse A. Fluid intake and epidemiology of urolithiasis. *European Journal of Clinical Nutrition* 2003;57(Suppl 2):S47-S51
- 45 Smith AJ and Shaw L. Mild dehydration: a risk factor for dental disease? *European Journal of Clinical Nutrition* 2003;57(Suppl 2):S75-80
- 46 Eisenbeiss C, Welzel J, Eichler W and Klotz K. Influence of body water distribution on skin thickness: measurements using high-frequency ultrasound. *British Journal of Dermatology* 2001;144:947-951
- 47 Principles of Human Nutrition. Ed M Eastwood. Chapter 8: Water, electrolytes, minerals and trace elements. London: Chapman & Hall 1997



Water UK represents UK water and wastewater service suppliers at national and European level.

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