Diagnostic test for gastrointestinal damage. Sucrose is not absorbed from the healthy gastrointestinal tract. It has been proposed that the absorption of sucrose could be used as a diagnostic test of gastric damage.[1-3]

1. Sutherland LR, *et al.* A simple non-invasive marker of gastric damage: sucrose permeability. *Lancet* 1994; **343:** 998–1000.
2. Meddings JB, *et al.* Sucrose permeability: a novel means of detecting gastroduodenal damage noninvasively. *Am J Ther* 1995; **2:** 843–9.
3. Kawabata H, *et al.* Sucrose permeability as a means of detecting diseases of the upper digestive tract. *J Gastroenterol Hepatol* 1998; **13:** 1002–6.

Gastrointestinal spasm. For mention of a beneficial effect of sucrose solution in infant colic, see p.1696.

Glycogen storage disease type V. Glycogen storage disease type V (McArdle's disease) is a rare autosomal recessive disorder characterised by mutations in the gene for myophosphorylase, an enzyme essential for glycogenolysis.[1,2] Patients present with exercise-induced pain, cramps, fatigue, and myoglobinuria which, if severe, can cause acute renal failure.[2] Low-dose creatine supplementation (60 mg/kg daily) produced modest benefits during ischaemic exercise testing, but higher doses (150 mg/kg daily) worsened symptoms.[2] Sucrose 75 g by mouth improved exercise tolerance in 12 patients in a randomised crossover study.[1] Uncooked corn starch, either alone or with sucrose, has been suggested as an alternative in order to avoid any pronounced increase in serum insulin,[3] but this has been rejected on the basis that the necessary rapid increase in blood glucose will not be produced.[4]

1. Vissing J, Haller RG. The effect of oral sucrose on exercise tolerance in patients with McArdle's disease. *N Engl J Med* 2003; **349:** 2503–9.
2. Quinlivan R, Beynon RJ. Pharmacological and nutritional treatment for McArdle's disease (glycogen storage disease type V). Available in The Cochrane Database of Systematic Reviews; Issue 2. Chichester: John Wiley; 2008 (accessed 21/07/08).
3. Gaglia JL, Wolfsdorf JI. Oral sucrose and exercise tolerance in McArdle's disease. *N Engl J Med* 2004; **350:** 1575.
4. Vissing J, Haller RG. Oral sucrose and exercise tolerance in McArdle's disease. *N Engl J Med* 2004; **350:** 1575–6.

Hiccup. Giving a teaspoon of dry granulated sugar resulted in the immediate cessation of hiccup in 19 of 20 patients;[1] 12 of the patients had suffered from hiccup for less than 6 hours but in the remaining 8 persistent hiccup had been present for 24 hours to 6 weeks. The effect may be due to stimulation of the pharynx. An early protocol for the treatment of intractable hiccup (p.976) suggests that swallowing dry granulated sugar is one of the first treatments that should be tried.

1. Engleman EG, *et al.* Granulated sugar as treatment for hiccups in conscious patients. *N Engl J Med* 1971; **285:** 1489.

Pain. A systematic review[1] concluded that sucrose solutions could reduce physiological and behavioural indicators of stress and pain in neonates undergoing painful procedures although there had been some doubt expressed[2] over whether this indicated effective analgesia. The review[1] was unable to determine an optimal dose, but 1 mL of a 25% solution or 2 mL of a 50% solution has been reported to reduce crying time in premature[3] and full-term[4] infants, respectively, when given 2 minutes before heel-prick sampling. Similarly, 2 mL of a 75% sucrose solution by mouth reduced crying time in infants given intramuscular vaccines,[5] and 2 mL of oral sucrose 24% reduced pain scores in premature infants undergoing eye examinations for retinopathy of prematurity.[6] One literature review[7] suggested that a dose of 500 mg sucrose provided effective analgesia for neonates. However, a randomised study found pacifiers (dummies) to have a better analgesic effect than 2 mL of a 30% sucrose solution; a synergistic effect was found with a combination of sucrose and pacifiers.[8] Another review[9] recommended that, along with a pacifier, 0.1 to 0.4 mL of a 24% sucrose solution be given to premature infants, and up to 2 mL be given to term infants. Others have recommended the use of 0.5 mL/kg of a 33% sucrose solution (about 170 mg/kg), stating that more dilute solutions carry a risk of bacterial contamination.[10] The route by which sucrose solution is given may also be important: a reduced pain response was only noted after intraoral doses; giving it via a nasogastric tube was ineffective.[11]

A study in preterm infants found that, while there were no differences on neurobehavioural developmental outcomes between infants given repeated sucrose analgesia or placebo, higher number of doses of sucrose predicted lower scores in motor development, vigour, alertness and orientation. The authors postulated that repeated stimulation by sucrose may interfere with normal functioning and maturation of the preterm infant's endogenous opiate system, and cautioned against the routine use of sucrose analgesia in this population.[12] For choice of analgesic in children, see p.3.

1. Stevens B, *et al.* Sucrose for analgesia in newborn infants undergoing painful procedures. Available in The Cochrane Database of Systematic Reviews; Issue 3. Chichester: John Wiley; 2004 (accessed 08/11/05).
2. Anonymous. Pacifiers, passive behaviour, and pain. *Lancet* 1992; **339:** 275–6.
3. Ramenghi LA, *et al.* Reduction of pain response in premature infants using intraoral sucrose. *Arch Dis Child* 1996; **74:** F126–F128.
4. Haouari N, *et al.* The analgesic effect of sucrose in full term infants: a randomised controlled trial. *BMJ* 1995; **310:** 1498–1500.
5. Lewindon PJ, *et al.* Randomised controlled trial of sucrose by mouth for the relief of infant crying after immunisation. *Arch Dis Child* 1998; **78:** 453–6.
6. Gal P, *et al.* Efficacy of sucrose to reduce pain in premature infants during eye examinations for retinopathy of prematurity. *Ann Pharmacother* 2005; **39:** 1029–33.
7. Masters-Harte LD, Abdel-Rahman SM. Sucrose analgesia for minor procedures in newborn infants. *Ann Pharmacother* 2001; **35:** 947–52.
8. Carbajal R, *et al.* Randomised trial of analgesic effects of sucrose, glucose, and pacifiers in term neonates. *BMJ* 1999; **319:** 1393–7.
9. Prince WL, *et al.* Treatment of neonatal pain without a gold standard: the case for caregiving interventions and sucrose administration. *Neonatal Netw* 2004; **23:** 33–45.
10. Shann F. Suckling and sugar reduce pain in babies. *Lancet* 2007; **369:** 721–3.
11. Ramenghi LA, *et al.* "Sucrose analgesia": absorptive mechanism or taste perception. *Arch Dis Child Fetal Neonatal Ed* 1999; **80:** F146–F147.
12. Johnston CC, *et al.* Routine sucrose analgesia during the first week of life in neonates younger than 31 weeks' postconceptional age. *Pediatrics* 2002; **110:** 523–8.

Wound healing. Sugar, either in the form of granulated sugar[1-5] or pastes composed of caster sugar and icing sugar,[6,7] has been used successfully in the treatment of wounds (p.1585) including mediastinitis after cardiac surgery,[1,3] large abscesses and bed sores,[6,7] diabetic ulcers,[2,4] and recurrent bone infections after surgical debridement in patients with leprosy.[5] Debridement of the wound is believed to be due partly to the osmotic effect of sugar and partly to the mechanical cleansing action but it is not known how sugar stimulates granulation tissue to form.[6,7] Once granulation tissue is well established and the wound is shrinking, an alternative wound preparation, such as an alginate, hydrocolloid, or hydrogel, should be used as sugar pastes cause bleeding.[8] Sugar is also effective at deodorising malodorous wounds. The use of the combined caster and icing sugar pastes, of which details of the formulas used are provided in the original publications,[6,7] has been advocated as a way to overcome the problems of possible non-sterility and contamination of commercial granulated sugar.[6,7]

Honey (p.1948) has been used similarly.

1. Trouillet JL, *et al.* Use of granulated sugar in treatment of open mediastinitis after cardiac surgery. *Lancet* 1985; **ii:** 180–4.
2. Quatraro A, *et al.* Sugar and wound healing. *Lancet* 1985; **ii:** 664.
3. De Feo M, *et al.* Treatment of recurrent postoperative mediastinitis with granulated sugar. *J Cardiovasc Surg* 2000; **41:** 715–19.
4. Kilic A. Healing of diabetic ulcers with granulated sugar. *Plast Reconstr Surg* 2001; **108:** 585.
5. Grauwin MY, *et al.* Comment guérir les ostéites et ostéo-arthrites des extrémités des anciens malades de la lèpre par le sucre cristallisé alimentaire? *Acta Leprol* 1999; **11:** 147–52.
6. Gordon H, *et al.* Sugar and wound healing. *Lancet* 1985; **ii:** 663–4.
7. Middleton KR, Seal D. Sugar as an aid to wound healing. *Pharm J* 1985; **235:** 757–8.
8. Seal DV, Middleton K. Healing of cavity wounds with sugar. *Lancet* 1991; **338:** 571–2.

Preparations

BP 2008: Compressible Sugar; Syrup;
Ph. Eur.: Sugar Spheres;
USNF 26: Compressible Sugar; Confectioner's Sugar; Sugar Spheres; Syrup.

Proprietary Preparations (details are given in Part 3)
Fr.: Gelodiet.

Multi-ingredient: ***Arg.:*** Equalsweet; Sucaryl; ***Austral.:*** Nyal Chesty Cough†; ***Irl.:*** Venos Expectorant; ***Jpn:*** U-Pasta; ***S.Afr.:*** Emetrol; ***UK:*** Honey & Molasses; Venos Cough Mixture; Venos Expectorant.

Sucrose Polyesters

Sacarosa, poliésteres de la.

Profile

A sucrose polyester that is a mixture of hexa-, hepta-, and octafatty acid esters of sucrose is used as a nondigestible fat substitute by the food industry. Fat substitutes have been promoted as part of a strategy to reduce fat and calories in the diet to aid bodyweight control.

Possible adverse effects of sucrose polyesters are flatulence, anal leakage, abdominal cramps, and loose bowel movements. They may also reduce the absorption of fat-soluble vitamins.

◊ References.

1. Cotton JR, *et al.* Replacement of dietary fat with sucrose polyester: effects on energy intake and appetite control in non-obese males. *Am J Clin Nutr* 1996; **63:** 891–6.
2. Goldman P. Olestra: assessing its potential to interact with drugs in the gastrointestinal tract. *Clin Pharmacol Ther* 1997; **61:** 613–18.
3. Cheskin LJ, *et al.* Gastrointestinal symptoms following consumption of olestra or regular triglyceride potato chips: a controlled comparison. *JAMA* 1998; **279:** 150–2.
4. Sandler RS, *et al.* Gastrointestinal symptoms in 3181 volunteers ingesting snack foods containing olestra or triglycerides. *Ann Intern Med* 1999; **130:** 253–61.
5. Bray GA, *et al.* A 9-mo randomized clinical trial comparing fat-substituted and fat-reduced diets in healthy obese men: the Ole Study. *Am J Clin Nutr* 2002; **76:** 928–34.

Preparations

Proprietary Preparations (details are given in Part 3)
India: Heartfelt†.

Sunflower Oil

Aceite de girasol; Auringonkukkaöljy; Helianthi annui oleum; Helianthi Oleum; Huile de Tournesol; Napraforgóolaj; Olej słonecznikowy; Oleum Helianthi; Saulėgrąžų aliejus; Slunečnicový olej; Solrosolja; Sonnenblumenöl; Sunflowerseed Oil; Tournesol, huile de.

Pharmacopoeias. In *Eur.* (see p.vii). Also in *USNF.*
Ph. Eur. 6.2 (Sunflower Oil, Refined; Helianthi Annui Oleum Raffinatum). The fatty oil obtained from the seeds of *Helianthus annuus* by mechanical expression or by extraction and then refined. A suitable antoxidant may be added. A clear, light yellow liquid. Practically insoluble in water and in alcohol; miscible with petroleum spirit (b.p.: 40° to 60°). Store in well-filled airtight containers. Protect from light.
USNF 26 (Sunflower Oil). A refined fixed oil obtained from the seeds of the sunflower plant *Helianthus annuus* (Asteraceae alt. Compositae). Specific gravity between 0.914 and 0.924 at 20°. Store in airtight containers. Protect from light.

Profile

Sunflower oil is the fixed oil expressed from the fruits of *Helianthus annuus.* It is used as a salad oil and in pharmaceutical preparations. It is rich in linoleic acid (p.2308).

Multiple sclerosis. As discussed on p.892, the role of dietary lipids in multiple sclerosis remains to be proven,[1] although many patients modify their diets and take supplements of sunflower and other oils. One study showed a reduction in severity and duration of relapse in patients taking linoleic acid supplements (as sunflower oil).[2] Another[3] reported benefit in patients who limited their intake of dietary saturated fatty acids and supplemented their diet with polyunsaturated fatty acids. A systematic review[4] of the relationship between dietary interventions (including linoleic acid given as sunflower oils) and multiple sclerosis concluded that there was insufficient evidence to determine their benefits or risks.

1. Anonymous. Lipids and multiple sclerosis. *Lancet* 1990; **336:** 25–6.
2. Millar JHD, *et al.* Double-blind trial of linoleate supplementation of the diet in multiple sclerosis. *BMJ* 1973; **1:** 765–8.
3. Swank RL, Dugan BB. Effect of low saturated fat diet in early and late cases of multiple sclerosis. *Lancet* 1990; **336:** 37–9.
4. Farinotti M, *et al.* Dietary interventions for multiple sclerosis. Available in The Cochrane Database of Systematic Reviews; Issue 1. Chichester: John Wiley; 2007 (accessed 22/04/08).

Preparations

Proprietary Preparations (details are given in Part 3)
Port.: Oleoban†.

Multi-ingredient: ***Arg.:*** Alofresh†; Prueboi†; ***Austral.:*** Snor-Away†; ***Austria:*** Pelsana Med; Piniment; ***Fr.:*** Oropur; ***Hong Kong:*** Sanjukei Panax Ginseng; ***India:*** Efaderm; ***Ital.:*** DHA; ***NZ:*** Snorenz; ***Port.:*** Oleoban Composto†; Oleoban Gel†; ***Switz.:*** Huile de millepertuis A. Vogel (huile de St. Jean); Pelsano; ***UK:*** Goodnight StopSnore; Snor-Away.

Tagatose

D-*lyxo*-hexulose; D-Tagatose; Tagatosum; Tagatoza.
$C_6H_{12}O_6$ = 180.2.
CAS — 87-81-0 (tagatose); 17598-81-1 (DL-tagatose).

Pharmacopoeias. In *USNF.*
USNF 26 (Tagatose). Tagatose is a ketohexose, an epimer of fructose inverted at C-4. It is obtained from galactose by isomerisation under alkaline conditions in the presence of calcium. White or almost white crystals, having a sweet taste. Very soluble in water; very slightly soluble in alcohol.

Profile

Tagatose is a naturally occurring monosaccharide, produced commercially from lactose. It is 92% as sweet as sucrose, but contains fewer calories. It may be used as a sweetener in foods, beverages, toothpaste, mouthwashes, and medicines.

Thaumatin *(BAN)*

E957; Katemfe; Taumatina.
CAS — 53850-34-3.

Profile

Thaumatin is a protein extracted from the fruit of *Thaumatococcus daniellii* (Marantaceae); it is a mixture of polypeptides thaumatin I and thaumatin II, each consisting of 207 amino acid residues and having a molecular weight of about 22 000. The amino-acid range excludes histidine. Thaumatin is an odourless, cream-coloured powder with an intensely sweet taste. The sweetness builds up gradually but persists for up to an hour, and is considered to be by far the sweetest of such compounds in use, having 2000 to 3000 times the sweetness of sucrose. It is approved as a sweetener and flavour modifier in foods, beverages, and pharmaceuticals.