

Should we use olive oil or sunflower oil on a preterm infant's skin?

Many health professionals recommend olive oil as a topical emollient for infant skin regardless of gestational age. A preterm infant's skin has a much thinner protective skin barrier than a term baby. The use of olive oil, which is high in oleic acid, has a damaging effect on the skin's protective barrier and therefore may further compromise the well-being of an already vulnerable baby. Alternatively, highly refined sunflower oil, which is very low in oleic acid, has positive antibacterial, moisturising and regenerative properties on the skin's protective barrier.

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Keywords

olive oil; sunflower oil; neonatal; premature; oleic acid; SCBU

Key points

de Meza T. Should we use olive oil or sunflower oil on a preterm infant's skin? *Infant* 2013; 9(5): 170-72.

1. Many health professionals recommend olive oil for emollient use on preterm and term infants' skin.
2. At 32 weeks' gestation, a baby's skin is immature and the protective skin barrier is thin.
3. The main constituent of olive oil is oleic acid, which can damage the stratum corneum.
4. Sunflower oil is very low in oleic acid and has properties that enhance the stratum corneum.
5. A review of practice guidelines is suggested to include recommendations for preterm infants' skin

This article arose from observations by a student midwife during a practice placement on a special care baby unit (SCBU). While caring for premature twins, a clear bottle containing a straw-coloured liquid was noticed among their belongings. The bottle had no label identifying either its ingredients or the infants' names. A neonatal nurse confirmed that the bottle belonged to the twins and it contained olive oil for their parents to use as a massage or touch medium. Not only was it extremely unsafe to have an unidentifiable bottle of liquid within the SCBU, but also literature suggests that olive oil should no longer be used on the skin of premature or term infants^{1,2}. Staff in the unit commonly recommended olive oil yet they had no written guidelines in support of its use.

The author conducted an informal survey of neonatal units across London to find out which oils were recommended for use. Of the 24 London hospitals verbally contacted, 19 stated that they used olive oil on the skin of preterm infants, either as an emollient or massage medium.

The role of the healthcare professional

The Nursing and Midwifery Council (NMC) code states nurses/midwives have a responsibility to ensure that all care, advice and information they provide is supported by up-to-date available evidence, which includes advice pertaining to the use of products³. For this reason, it is unacceptable to provide care based only on tradition and routine. For health

professionals to be able to provide suitable skincare advice, it is necessary to first have a clear understanding of the anatomy, physiology and function of human skin. It is also crucial to have an understanding of the differences between the skin of a baby born at term (**FIGURE 1**) and that of a baby born prematurely (**FIGURE 2**).

Structure and function of the skin

The skin is the largest organ of the human body, possessing a variety of essential functions. Its primary function is to act as a protective barrier against external pathogens and environmental allergens, toxins and irritants. In addition it acts as a sensory organ to touch, pressure and temperature and also maintains thermo-regulation, prevents dehydration and helps in the elimination of waste products. Skin consists of three main layers:

1. The epidermis, the outermost layer
2. The dermis, the middle layer
3. The hypodermis, a deep layer of subcutaneous fatty tissue.

The stratum corneum – the 'skin barrier' – is the most superficial layer of the epidermis. Exposed at the surface of the skin, the stratum corneum is made up of keratinocytes surrounded by lipid layers in a formation comparable to bricks and mortar; the bricks representing the keratinocytes and the mortar the surrounding lipid layers⁴.

Structure of a neonate's skin

Babies born at term (37-42 weeks' gestation) have a skin structure resembling

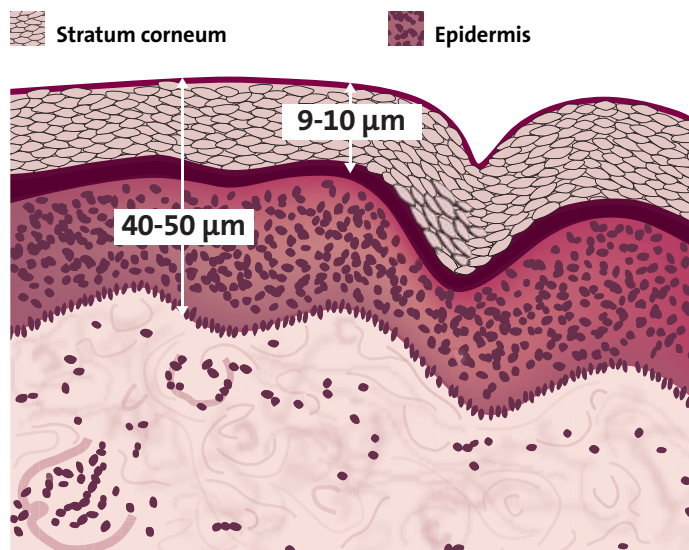


FIGURE 1 Full-term neonatal skin.

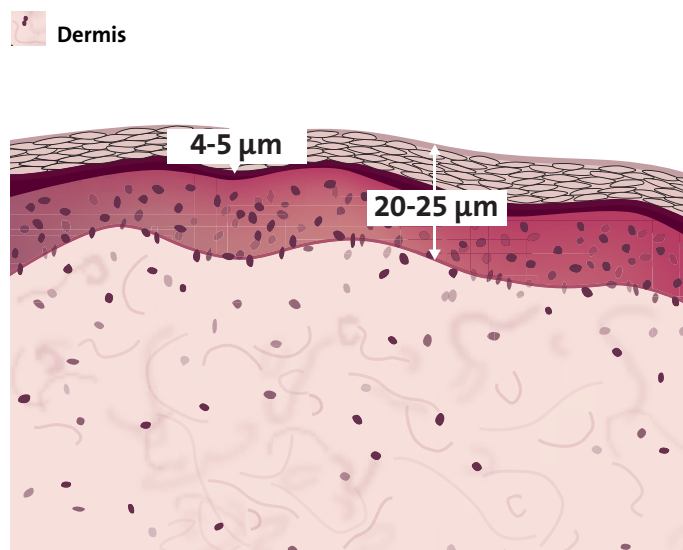


FIGURE 2 Fetal skin at 25 weeks' gestation.

that of an adult however, a baby's skin is more vulnerable and less mature than adult skin. The stratum corneum and the epidermis are much thinner and contain fewer lipid layers, resulting in increased permeability, increased rate of transepidermal water loss (TEWL) and therefore reduced barrier function⁵. Premature infants have immature immune systems, contributing to their continuous risk of infection, and their skin barrier status is dependent on their gestational age at birth⁶. At approximately 32 weeks' gestation the layers that make up the epidermis are complete but still very immature, with the stratum corneum only 2-3 cells thick⁷. Consequently, extra special care should be taken to preserve the integrity of their skin to reduce the risk of acquired infections⁸.

Neonatal skin undergoes a progressive adaptation to the extra-uterine environment. The skin of a newborn baby born at term has a pH of 6.34, which reduces to approximately 4.95 in the days following birth, to around 4.7 over the following month⁹. The low pH of the skin surface creates an 'acid mantle' that helps protect against potentially harmful bacteria. Maintaining this pH is essential for providing a protective barrier function and for the maturation of the stratum corneum.

Due to the increased rate of TEWL in both premature and term infants, the skin becomes dry in the neonatal period and goes through a process of desquamation⁷. The skin barrier continues to develop and is not fully mature until 12 months following birth¹⁰. As a neonate's body

surface to body weight ratio is higher than an adults, their skin has increased vulnerability to the use of topical agents¹¹.

Literature review: olive oil or sunflower oil?

Baby massage has been practised for centuries in many cultures worldwide. 'Positive touch' is a therapy designed to allow parents of premature infants the precious opportunity to have gentle, loving contact while in the special care baby unit¹². Oil is used as a lubricant to prevent friction of the skin. Research demonstrates that positive touch therapy enhances the emotional development and weight gain of the preterm infant and also promotes maternal-infant attachment¹³.

The National Institute for Health and Care Excellence (NICE) postnatal care guideline does not mention or recommend oils for use on a baby's skin, whether preterm or term¹⁴. Despite this, a qualitative study discovered that many mothers use olive oil on their babies' skin, as it is recommended by health professionals as an emollient to alleviate dry skin in the early neonatal period¹⁵. There is no available evidence to support the use of olive oil.

When vegetable oils are used for topical application on the skin they penetrate the stratum corneum¹⁶. Various research studies have revealed that oils containing high concentrations of oleic acid can damage the skin's protective barrier^{17,18}. Even small amounts of oleic acid disrupt the lipid barrier in the stratum corneum, which consequently causes increased skin permeability, inducing skin barrier break-

down. The main constituent of olive oil is oleic acid, comprising 55-85% of the oil¹⁹.

Based on these research findings an international clinical expert group in paediatric dermatology stated that the use of olive oil as a topical medium on the skin of babies should be avoided¹. Similarly, the International Association of Infant Massage (IAIM) does not recommend the use of olive oil for infant massage². However, a recent survey of maternity and neonatal units in the UK found that olive oil was the most widely recommended oil with 81.6% of the units recommending its use as an emollient or for positive touch therapy²⁰.

In contrast to the high percentage found in olive oil, sunflower oil has only 16-19% oleic acid and is comprised mostly of linoleic acid (68-72%)²¹. Sunflower oil mirrors skin lipids, resembling the naturally occurring sebum in human skin. It has regenerative, restructuring and moisturising properties due to its high essential fatty acid content, namely the linoleic acid that enhances the skin barrier²². Studies on mice revealed that a single application of sunflower oil on damaged skin significantly accelerated skin barrier recovery within one hour of application, with the effect still visible five hours later¹⁸. Comparable findings were discovered regarding the anti-bacterial effect of sunflower oil and its ability to restore the intracellular lipids, reducing the occurrence of dermatitis²³. However, it was noted that the risk of nosocomial infections was increased and therefore it was advised that emollients should not routinely be used on premature infants. In

contrast, research studies conducted within neonatal units in Bangladesh and Egypt found that the topical use of sunflower oil on preterm infants considerably improved skin condition and dramatically reduced the incidence of nosocomial infections and mortality²⁴⁻²⁷.

Refined oil is free from impurities, thin in texture, has almost no smell and has a longer shelf life²⁸. The refining process destroys allergen-bound proteins, reducing the risk of allergic reaction²⁹. Consequently, highly refined sunflower oil is safe, non-toxic and recommended for use on premature infants' skin for positive touch therapy^{12,30}. Comparatively, cold-pressed oils are not sterile and as such may contain bacteria and fungal spores, which may grow when they have access to moisture on the skin³¹.

Summary and recommendations

Research carried out over the last 15 years has revealed the damaging effects of olive oil on the skin barrier. The skin of an infant born at term is not fully mature until at least 12 months of age and a preterm infant's skin is far more vulnerable. Despite the wealth of evidence that promotes the benefits of sunflower oil, too many health professionals still recommend olive oil as a topical skin emollient for all infants.

Substantial research has revealed the benefits of topical use of sunflower oil on a preterm infant's skin. It has been found to promote barrier function and reduce bacterial infections, so much so that a clinical expert group in paediatric dermatology and also the IAIM no longer recommend the use of olive oil¹². Highly refined oil is safer to use, as it is unlikely to cause a skin allergy. In order to ensure that the use of sunflower oil in the hospital setting complies with current safety measures, all bottles should be manufactured, labelled and provided by the hospital to avoid any risk of contamination or the illegal practice of decanting oil into unsuitable containers.

Highly refined food-grade sunflower oil is used in the SCBUs of two London hospitals. The clear, pale yellow, odourless oil is manufactured in the UK and bottled and labelled within a UK hospital pharmacy¹². It is supplied in small 50mL plastic bottles to prevent it from becoming rancid; bottles are not meant to be shared and therefore should be labelled with each baby's identity.

Fractionated coconut oil is also recommended for topical use on preterm infants in the SCBU as an alternative to sunflower oil¹², however further empirical research should be undertaken to support its use. In order to initiate a change in current practice, the author recommends that NICE review its postnatal guidance to include recommendations for preterm infants' skin.

References

- Frieden I.J., Blume-Peytavi U., Torrello A., Cork M.J. *Emollient Use on Infant Skin: Recommendations for the Primary Care Practice*. Proceedings of the Excellence in Paediatrics Conference: cutting edge topics by outstanding speakers. [Online] 2011. Available from: http://2012.excellence-in-paediatrics.org/sites/default/files/KOL%20session%20-%20Emollient%20use%20on%20infant%20skin_0.pdf [Accessed 28 July 2013].
- International Association of Infant Massage. *Baby Massage Frequently Asked Questions and Answers: What Can I Use to Massage my Baby?* [Online] 2011. Available from: www.iaimbabymassage.co.uk/baby-massage-questions-and-answers.html#29 [Accessed 28 July 2013].
- Nursing and Midwifery Council. *The Code – Standards of Conduct, Performance and Ethics for Nurses and Midwives*. London: NMC; 2008.
- Waugh A., Grant A. *Ross and Wilson: Anatomy and Physiology in Health and Illness*. 11th edition. Edinburgh: Churchill Livingstone; 2010.
- Nonato L.B., Kalia Y.N., Naik, A. et al. The development of skin barrier function in the neonate. *J Toxicol Cutaneous Ocul Toxicol* 2005;20:335-66.
- Stables D., Rankin J. Health challenges and problems in neonates of low birth weight. In: Stables D., Rankin J. eds. *Physiology in Childbearing: with Anatomy and Related Biosciences*. Edinburgh: Baillière Tindall; 2011, pp. 667-81.
- Hoeger P.H. Physiology of neonatal skin. In: Harper J., Oranje A., Prose N. eds. *Textbook of Pediatric Dermatology*. Oxford: Blackwell Publishing; 2006, pp. 42-47.
- Stoll B.J. Infections of the neonatal infant. In: *Nelson Textbook of Paediatrics*. 19th edition. Philadelphia: WB Saunders/Elsevier; 2011, pp. 629-49.
- Kenner C., Wright Lott J. *Comprehensive Neonatal Care: An Interdisciplinary Approach*. Philadelphia: W.B. Saunders/Elsevier; 2007.
- Stamatas G.N., Nikolovski J., Mack M.C., Kollias N. Infant skin physiology and development during the first years of life: a review of recent findings based on in vivo studies. *Int J Cosmet Sci* 2011;33:17-24.
- Nikolovski J., Stamatas G.N., Kollias N., Wiegand B.C. Barrier function and water holding and transport properties of infant stratum corneum are different from adult and continue to develop through the first year of life. *J Invest Dermatol* 2008;128:1728-36.
- Bond C. *Positive Touch Programme in the Neonatal Unit*. [Online] 2012. Available from: www.cherrybond.com/Positive%20Touch%20Programme%20in%20the%20NICU.html [Accessed 28 July 2013].
- Field T., Diego M., Hernandez-Reif M. Preterm infant massage therapy research: a review. *Infant Behav Dev* 2010;33:115-24.
- NICE. *Routine Postnatal Care of Women and Their Babies*. London: NICE; 2006.
- Lavender T., Bedwell C., Tsekiri-O'Brien E. et al. A qualitative study exploring women's and health professionals' views of newborn bathing practices. *Evidence Based Midwifery* 2009;7:112-21.
- Stamatas G.N., de Sterke J., Hauser M. et al. Lipid uptake and skin occlusion following topical application of oils on adult and infant skin. *J Dermatol Sci* 2008;50:135-42.
- Naik A., Pechtold L.A.R.M., Potts R.O., Guy R.H. Mechanism of oleic acid-induced skin penetration enhancement in vivo in humans. *J Control Release* 1995;37:299-306.
- Darmstadt G.L., Mao-Qiang M., Chi E. et al. Impact of topical oils on the skin barrier: possible implications for neonatal health in developing countries. *Acta Paediatr* 2002;91:546-54.
- Price L., Price S. *Carrier Oils: for Aromatherapy and Massage*. 4th edition. Stratford-Upon-Avon: Riverhead; 2008.
- Cooke A., Cork M.J., Danby S., Lavender T. Use of oil for baby skincare: a survey of UK maternity and neonatal units. *Br J Midwifery* 2011;19:354-62.
- Skoric D., Jovic S., Sakac Z., Lecic N. Genetic possibilities for altering sunflower oil quality to obtain novel oils. *Can J Physiol Pharmacol* 2008;86:215-21.
- Eichenfield L.F., McCollum A., Msika P. The benefits of sunflower oleodistillate (SOD) in paediatric dermatology. *Pediatr Dermatol* 2009;26:669-75.
- Conner J.M., Soll R.F., Edwards W.H. Topical ointment for preventing infection in preterm infants. *Cochrane Database Syst Rev* 2003; DOI:10.1002/14651858.
- Darmstadt G.L., Badrawi N., Law P.A. et al. Topically applied sunflower seed oil prevents invasive bacterial infections in preterm infants in Egypt: a randomised, controlled, clinical trial. *Pediatr Infect Dis J* 2004;23:719-25.
- Darmstadt G.L., Saha S.K., Ahmed A.S. et al. Effect of topical emollient treatment of preterm neonates in Bangladesh on invasion of pathogens in to the bloodstream. *Pediatr Res* 2007;61:588-93.
- Darmstadt G.L., Samir K.S., Ahmed A.S. et al. Effect of skin barrier therapy on neonatal mortality rates in preterm infants in Bangladesh: a randomised, controlled, clinical trial. *Pediatrics* 2008;121:522-29.
- Lefevre A., Shillcut S.D., Saha S.K. et al. Cost-effectiveness of skin barrier enhancing emollients among preterm infants in Bangladesh. *Bull World Health Organ* 2010;88:104-12.
- Food and Agriculture Organization of the United Nations. *Agribusiness Handbook: Sunflower Crude and Refined Oils. Sunflower Seed Processing into Oil*. [Online] 2010. Available from: <ftp://ftp.fao.org/docrep/fao/007/ae375e/ae375e00.pdf> [Accessed 28 July 2013].
- Hefle S.L. Impact of processing on food allergens. *Adv Exp Med Biol* 1999;459:107-19.
- Rojas-Molina M., Campos-Sanchez J., Analla M. et al. Genotoxicity of vegetable cooking oils in the *Drosophila* wing spot test. *Environ Mol Mutagen* 2005;45:90-95.
- Callaghan C. *Sunbird Management. Sunbird Oils: Vegetable Oils – Problems with Cold Pressed Oils*. Personal Communication. 27 August 2013.