



Maximising the role of multisensory stimulation in infant development:

The benefits of a bath time routine

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Introduction

The early months of gestation through to the first few years of a child's life are the most important in terms of brain development, since this is the time in which the brain grows fastest and is the most responsive to external factors (Eliot, 1999). A baby's brain creates up to 1.8 million new synaptic connections in the brain per second, and what a baby feels, sees, hears and smells determines which of these connections survive (Eliot, 1999). Experiences involving multisensory stimulation – the concurrent stimulation of tactile (touch), olfactory (smell), auditory (sound), and/or visual (sight) senses – improves a baby's development. This is because stimulating multiple senses sends signals to the brain that enhance the processes for emotional, cognitive and physical development (Shams et al, 2008; Sullivan et al, 1991). Guidelines recommend that multisensory interactions should be at the core of early care for babies (WHO/UNICEF, 2012).

In light of the benefits multisensory stimulation has on an infant's development, it is important that healthcare professionals, such as midwives, are aware of the evidence base. This supplement examines the clinical research and published evidence on multisensory stimulation and gives practical advice on how you can encourage parents to incorporate multisensory stimulation as part of everyday routines to promote healthy brain development.

Five key facts

1. Multisensory stimulation enhances healthy infant development and is recommended by the World Health Organization
2. Consistent sensory experiences can reduce infant stress, increase alertness, improve sleep and aid feeding and weight gain
3. A bath time routine comprising bath, massage and quiet time (e.g. reading) provides tactile, visual, auditory and olfactory stimulation
4. Bath time routines can promote the social, emotional, cognitive and physical development of infants
5. Adopting a three-step bath time routine has been shown to be easy for parents to implement, with 87% of parents studied continuing to use the routine at least half the time, at one-year follow-up

(Ang et al, 2012; Dehaene-Lambertz et al, 2010; Diego et al, 2005; Farroni et al, 2002; Field et al, 2008; Field et al, 2008; Field et al, 1996; Hart et al, 1998; Hernandez-Reif et al, 2007; Lee, 2005; Mindell et al, 2009; Mindell et al, 2011; Peláez-Nogueras et al, 1996; Shams et al, 2008; Sullivan et al, 1991; Sullivan et al, 1998; White-Traut et al, 2009; WHO/UNICEF, 2012)

Benefits of the individual senses

Touch as a technique for cognitive and physical development

In the womb, one of the first sensory stimulations experienced by a baby is touch, and skin-to-skin

contact between newborn infants and their parents has been found to have many beneficial effects (Field, 2014; Anderzeén-Carlsson et al, 2014). Routine touch and massage have been shown to benefit healthy baby development through improving communication.

In a study of ten infants there was a 50% increase in eye contact and more smiles and vocalisations in those who received routine touch and massage compared with those that did not (Peláez-Nogueras et al, 1996). Tactile stimulation improves cognitive performance and

results in increased alertness and attentiveness (Hart et al, 1998), as well as increasing physical activity in pre-term infants (Lee, 2005). Studies have shown that touch and massage can improve sleep quality and duration as part of a consistent routine (Mindell et al, 2009).

Sight as stimulation for social development

Enriching visual stimulation facilitates early communication, demonstrates enhanced neural processing and provides a foundation for social development (Farroni et al, 2002). During the first four months of life, infants begin to follow moving objects with their eyes and begin to reach out for things close to them, showing developing depth perception (AOA, 2014). Eye contact is an essential mode of communication. Infants quickly learn that important information, such as a meaningful smile, is expressed by observing behaviours of the people around them, an important skill for social development (Farroni et al, 2002). Making direct eye contact with infants is beneficial as newborns prefer looking at faces, ideally with open eyes, and they tend to mimic facial expressions (Farroni et al, 2002). A study has shown that newborns exposed to a direct gaze showed enhanced neural processing compared with an averted gaze (Farroni et al, 2002).

Sound as a means for language development and learning

Speech, music and environmental sounds create memory in the auditory and language areas of the cortex and generate neurological connections to emotional memories in infants (Graven et al, 2008). The auditory system starts functioning at around 25 weeks gestation and is at its critical development stage between then and up to six months of age (Graven et al, 2008). Talking and singing to infants in the womb

and environmental sounds, such as rubbing the pregnant stomach, facilitates auditory stimulation (Graven et al, 2008).

Lullabies sung live to preterm infants improved feeding behaviours, enhanced bonding between infant and parent and decreased stress associated with preterm care (Loewy et al, 2013). A study has shown that when preterm infants receive three live music interventions per week within a two-week period, their heart rate lowered (Loewy et al, 2013). Infants hearing breathing sounds that imitated their own breathing had lowered heart rates and positive differences in sleep patterns (Loewy et al, 2013). Calorific intake and sucking behaviour also increased when parent-preferred lullabies were sung to preterm infants (Loewy et al, 2013).

Auditory stimulus also plays a role in language development. When infants hear their mother's voice, rather than a stranger's voice or music, they show enhanced activity in the linguistic processing part of the brain (Dehaene-Lambertz et al, 2010). Studies have also shown that infants who are spoken to more often have larger vocabularies by 24 months of age (Weisleder et al, 2013).

Smell boosts memory development

The sense of smell is unique as, unlike other senses, olfaction signals are transmitted directly from the environment to the highest centres of the brain for processing, without stopping first at the thalamus (Bastir et al, 2011; Herz et al, 2004). Smell is also the sense most directly linked to memory; memories are more emotional when triggered by smell than by other senses (Herz et al, 2004; Willander et al, 2007). Research demonstrates infants are able to differentiate their mother's smell from that of other women within days of birth (Sullivan et al, 1998).

Babies learn to respond to odours rapidly after birth and exhibit a conditioned response when scent is combined with touch (Sullivan et al, 1991). Olfactory stimulation also reduces pain and stress reactions (Rattaz et al, 2005).

Flavour is multisensory

The flavour of food or drink is the result of multisensory integration stimulation via smell, oral chemical somatosensory stimulation and taste systems (Beauchamp et al, 2011). Although these systems work independently, they converge to create a single flavour perception. Exposure to different flavours in the womb and after birth can affect taste preferences in later life.

Fast facts

- Routine touch and massage has a number of benefits on development, including improved cognitive performance, increased alertness, reduced stress, improvements in sleep and weight gain
- Eye contact is an important form of communication and is important in developing social skills
- The sounds babies hear impacts their neurological development and learning
- Stimulating babies' sense of smell contributes to healthy baby development and can help reduce their reactions to pain and stress

(Ang et al, 2012; Dehaene-Lambertz et al, 2010; Diego et al, 2005; Farroni et al, 2002; Field et al, 2008; Field et al, 2008; Field et al, 1996; Hart et al, 1998; Hernandez-Reif et al, 2007; Lee, 2005; Loewy et al, 2013; Mindell et al, 2009; Peláez-Nogueras et al, 1996; Rattaz et al, 2005; Weisleder et al, 2013; White-Traut et al, 2009)

Benefits of multisensory stimulation

Multisensory stimulation, or the concurrent stimulation of touch, smell, auditory, and/or visual stimuli, occurs when stimuli from different sensory inputs converge in the brain, allowing integration and relationship development between the senses (Clemo et al, 2012).

Enriched multisensory experiences are beneficial to healthy development throughout childhood and are recommended by the World Health Organization as a core component in early infant care (WHO/UNICEF, 2012).

Stimulating multiple senses sends signals to the brain that strengthen the neural processes promoting cognitive, social, emotional and developmental benefits (WHO/UNICEF, 2012). With 85% of a baby's brain developed by the age of three (Bruner et al, 2004; WHO/UNICEF, 2012), experiences that enhance this process are vital.

Developmental benefits

Ensuring babies achieve consistent sensory experiences directly contributes to developmental

benefits, such as (Mindell et al, 2009; White-Traut et al, 2002; White-Traut et al, 2009):

- Reduced stress in healthy and pre-term infants
- Increased alertness in pre-term infants
- Better quality and duration of sleep in healthy babies
- Faster progression to complete bottle feeding via a teat and reduced hospitalisation time in preterm infants

The ability to reduce infant stress is critical as stress directly affects brain development, starting during gestation, and continuing to have an effect during the first three years of life (WHO/UNICEF, 2012). A study comparing stress reactivity in 40 healthy newborn infants found that those receiving multisensory stimulation showed a significantly steady decline in the stress hormone cortisol, compared with those who received tactile-only or no stimulation (White-Traut et al, 2009).

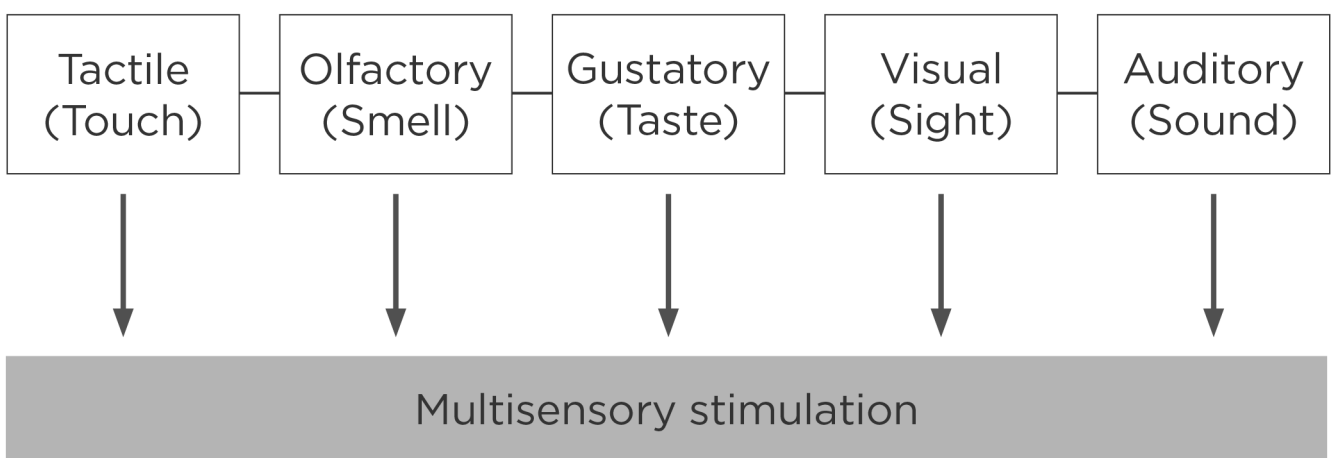


Figure 1: A multisensory approach

Bath time: An ideal opportunity for multisensory stimulation

Everyday routines, such as bath time, provide an ideal opportunity for incorporating multisensory stimulation (see Figure 2). This creates an enriching environment to stimulate the senses and promote parent-child bonding (Blume-Peytavi et al, 2009; Blume-Peytavi et al, 2012). For example, mothers who gave their babies a scented bath were more relaxed, and smiled and touched their infants more during the bath, compared with those who used

an unscented bath product (Field et al, 2008).

When advising parents on a bath time routine, recommend incorporating a warm bath and massage followed by quiet time, such as reading a book before bed, as this encompasses a range of multisensory elements (see Figure 2):

- Tactile stimulation via skin-to-skin contact in the bath and during massage
- Visual stimulation by engaging in direct eye contact
- Auditory stimulation via the parent's voice talking during bath, massage and quiet activities
- Olfactory stimulation through the use of baby-skin appropriate scented bath and massage products



What baby hears

- Sounds and lullabies may improve feeding behaviours and sucking patterns (Loewy et al, 2013)
- Talking and singing aids linguistic development (Dehaene-Lambertz et al, 2010; Weisleder et al, 2013)



What baby smells

- A lavender-scented bath has been shown to increase the amount of time babies look at their mother and the time spent in deep-sleep post-bathing
- The mother-infant relationship may be strengthened through recognition and association of odour (Sullivan et al, 1991)



What baby feels

- A calming, soothing, tactile experience that promotes a bond with the parent (Blume Peytavi et al, 2009; Blume-Peytavi et al, 2012)
- Less stressed from massage (Field et al, 2008)
- More relaxed when the bath is scented, cries less (Field et al, 2008)
- In addition, the parent giving the scented bath was relaxed and smiled and touched their baby more during the bath (Field et al, 2008)



What baby sees

- A powerful communicative link via direct eye contact, stimulates their neural processing and forms the foundation for later development of social skills (Farroni et al, 2002)

Figure 2: Multisensory stimulation via a bath time routine

Benefits of a bath time routine

Bath time is an ideal opportunity for multisensory stimulation. Bathing promotes bonding and has been shown to be a calming, soothing experience for babies (Blume-Peytavi et al, 2009). Massage alone has been shown to help reduce stress; with data showing preterm infants receiving skin-to-skin massages had fewer stress behaviours (Hernandez-Reif et al, 2007), and mothers also showing a reduction in anxiety and depression scores (Feijo et al, 2006). In addition, massage helps babies fall asleep faster (Field et al, 2001) and, among infants of low birthweight, reduced snoring and night-time feeding, while increasing day time alertness (Kelmanson et al, 2006). Massage has also been clinically proven to help preterm infants gain weight and have improved gastric motility (Diego et al, 2007).

Parental perception of bath time

According to market research of 500 UK parents, the majority believe bath time offers more than the opportunity to clean their child; it also provides quality time and a way to build lasting memories (J&J, 2015). There is though a lack of awareness of the benefit of bath time in their baby's cognitive development, with just 37% believing it has an extremely important role (J&J, 2015).

The multisensory elements of bath time may also be overlooked; half of UK parents do not regard suitably fragranced products as being important when bathing their child and the majority are unaware that baby massage can play a vital part in infant brain development (J&J, 2015).

Bath time can be used as part of a multisensory bedtime routine to help babies sleep better. In a study of infants aged 7-36 months, parents were asked to follow their infants' usual pre-bed routine for one week, they were then randomly selected to either follow a three-step multisensory pre-bedtime bath routine (bath, massage, and quiet time) or their

usual pre-bed routine (control) for a further two weeks (Mindell et al, 2009). The study found that, by the second week, those infants receiving a pre-bedtime bath routine fell asleep faster and slept longer, and maternal mood was also improved. In contrast, the control group showed no significant changes versus baseline.



Putting the evidence into practice

Encouraging parents to develop a bath time routine should focus not only on the developmental benefits for baby, but also how it will benefit the parents themselves. Key among these is the desire for an uninterrupted night's sleep. A study has shown that parents who implemented a

three-step pre-bedtime routine of bath, massage and quiet time, used in combination with an internet tool (this provided a customised sleep profile and corresponding advice based on information on their infants' sleeping pattern), had improved infant and maternal sleep at

one year follow up versus initial baseline (Mindell et al, 2011). In addition, mothers following the three-step pre-bedtime routine also reported less tension, depression, anger and fatigue (Mindell et al, 2009).

There are some practical considerations that should be recommended to parents for every stage of the pre-bedtime bathing routine:



1. Warm bath

- Washing infants in a bath is generally superior to sponge bathing as it can provide more tactile stimulation, helps prevent temperature loss and is a calming, soothing experience for the infant (Blume-Peytavi et al, 2009; Blume-Peytavi et al, 2011; Bryanton et al, 2004)
- Use of a lavender-scented bath time product has been shown to lower baby's stress levels and crying and promote sleep and visual engagement with the parent (Field et al, 2008)
- Advise parents to use a mild liquid cleanser that causes minimal disruption to the pH of their baby's skin and that does not irritate the skin or eyes (AWHONN, 2013). In general, liquid cleansers often contain emollients so are preferable to cleansing bars, but choose products with sufficient quantity of baby-suitable preservatives. Antibacterial soaps should be avoided



2. Massage

- Massaging with oil or lotion has greater soothing effects than massage alone; with one study in healthy newborns showing massaging with oil resulted in less stress for babies (Field et al, 1996)



3. Quiet time

- These include reading a book together, lullabies and cuddling, and should be the final step in the routine. Aim to have lights out within 30 minutes after the end of the bath (Mindell et al, 2009)

A study has shown that, after one year, 87% of parents studied continued to use this three-step routine at least half the time (Mindell et al, 2011), indicating that a bath time routine such as the one suggested is easy to follow and implement in everyday practice.



Conclusion

A simple bath time routine is an easy way for parents to incorporate multisensory stimulation that can help their child's cognitive, social, emotional and physical development. Consistent use of sensory experiences can reduce infant stress, increase alertness, improve sleep and aid feeding and weight gain.

Although 88% of UK parents surveyed (n=500) say they have a routine around bath time (J&J, 2015), they may not be doing this consistently and they may not

adopt an optimised and consistent routine to maximise multisensory stimulation. With more than 90% of parents seeking to enhance their baby's development (J&J, 2015), there is a clear opportunity for improved education around how a multisensory approach can help.

As synaptic formation in babies' brains continues throughout much of the first year, with twice as many produced as will ever be needed, it is experience that determines which will develop and which will wither. Encouraging parents to

adopt a multisensory approach early in life may be highly influential in shaping enhanced synapse formation and life skills.

Improving existing bath time routines to ensure they encompass massage and quiet time can not only tackle immediate issues, such as sleep, but can also promote the longer-term benefits in healthy baby development.



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