Pedagogical resources
AQUATIC ACTIVITIES

THE BARE HEAD. THE EAR AS A GATEWAY TO AQUATIC PROPRIOCEPTION

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Allowing the baby's head and ears to be in contact with water during the first few months of life can promote the baby's vestibular, sensory, psychomotor and emotional development. This document presents, based on scientific evidence, the rationale for not using swimming caps on newborns and infants, as well as recommendations for aquatic practice.

Introduction

The practice of putting swimming caps on newborns and babies just a few weeks old is not only often unnecessary from a hygienic point of view at these ages, but it can also be **counterproductive to their sensory development and reflex integration**. Water is not the first place where the ear "learns" to hear: the baby already comes from a liquid environment (the amniotic fluid) where its ear has been fully active and intimately connected to movement and space.

The baby arrives in the world with an ear "trained" in hydrodynamics and liquid acoustics. To interrupt this with a plastic cap is to break a developmental continuity.

Neurophysiology of the free ear

Physiologically, the ear is the **first sensory organ to mature in the womb**. Its development is characterised by two critical phases: the structural and the functional.

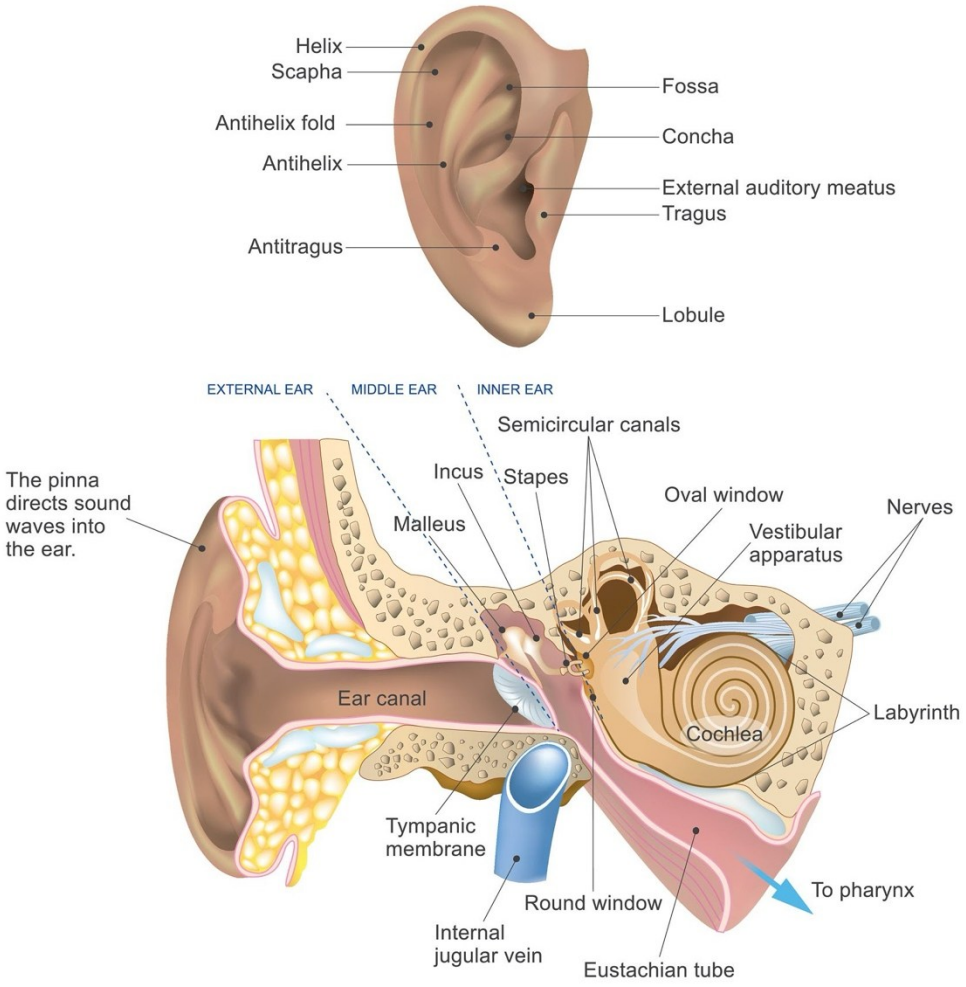
Structurally, it is during the first few weeks of life that the auditory system begins to develop. Around the 4th or 5th week of gestation, the structures of the inner ear (the cochlea and the semicircular canals) begin to differentiate from the ectoderm. And it is between the 12th and 16th weeks that the ear is practically fully formed anatomically, including the ossicles of the middle ear.

The real revolution takes place at the functional level. Between weeks 16 and 19, the foetus begins to register its first physical and neurobiological responses to internal auditory stimuli (for example, the mother's heartbeat). According to Hepper & Shahidullah (1994, p. F84), "*from week 19 of gestation onwards, the foetus begins to respond consistently to pure auditory stimuli*".

It is from week 24 onwards that the nervous system completes its connection with the cochlea, enabling the foetus not only to react to somatic vibrations, but also to actively hear the outside world (filtering out music, reacting to, and distinguish between the father's and mother's voices), as "*prenatal exposure to low-frequency sounds transmitted through the amniotic fluid —such as the mother's voice and heartbeat— promotes brain plasticity and the normal development of the auditory processing areas in the cortex*" (Webb et al., 2015, p.

3154).

Figure 1. Structural anatomy of the human auditory system and vestibular apparatus.
Source: Graphic_BKK1979 / Getty Images.



The sensorimotor functional unit: impact on psychomotor development

The ear is not merely the organ of hearing: it should not be understood solely as a receptor of sound waves; it houses the vestibular system, a key component in the development of body awareness and motor skills. Keeping the ears uncovered and unobstructed in water has a direct influence on critical variables of psychomotor development:

- **Spatial and temporal orientation.** As sound travels approximately 4.5 times faster in water than in air, the baby relies on unobstructed binaural hearing to construct a sense of three-dimensionality. According to Rigal (2006, p. 320), spatial orientation results from the

integration of visual, kinaesthetic and auditory signals. Wearing a swimming cap dampens acoustic input, meaning the brain receives distorted information, hindering the ability to echolocate, hemispheric symmetry and the gradual establishment of lateral dominance.

- **Head control and neck stability:** Unrestricted contact with water stimulates the labyrinthine righting reflexes, physiologically and naturally enhancing the activation of the deep neck muscles (trapezius and sternocleidomastoid muscles), leading to the autonomous attainment of neck verticality. According to Ayres (2008, p.64), "The vestibular system is the body's frame of reference. It is the sense that tells us where we are in relation to gravity, whether we are moving or stationary, and at what speed and in what direction we are moving. The vestibular system processes information about gravity and head movement, and helps to keep the eyes fixed on a point and to maintain posture and balance".
- **Facial tone and the vagus nerve:** The skin surface of the outer ear and the temples is densely innervated by the trigeminal (V) and facial (VII) cranial nerves. The hydrodynamic movement of free-flowing water in contact with the skin's surface reflexively tones the facial muscles involved in facial expressions, which are crucial for the future development of speech articulation and chewing. The pressure of the water and its direct contact have a positive effect on the vagus nerve (X), inducing a sense of calm, which is ideal for motor learning.

The swimming cap as a barrier to the emotional and secure bond

From the practice of water-based education at an early age, a child's first experiences in water – in the bath and at home, and later in the swimming pool – provide opportunities for emotional learning and non-verbal communication. A restrictive garment worn over a baby's head may interfere with and distort the development of this healthy attachment to water.

According to Bowlby's attachment theory (1989, p. 24), the primary role of carers is "to provide a secure base from which a child [...] can venture out into the outside world and to which they can return". In a novel and unfamiliar environment such as the aquatic environment, the baby needs to experience that secure base clearly and positively.

Putting a swimming cap on a baby can alter their perception of the world and their experience of it in various ways:

- **Emotional deafness**. The frequencies of the father's or mother's voice (the child's primary signal of safety and calm in their environment) reach the infant's brain in a distorted form. Faced with this auditory distortion, the baby may respond with behaviours of insecurity, stress and discomfort towards stimulation and play. Furthermore, the swimming cap is a foreign object that can trigger episodes of sensory stress (tactile hyperaesthesia) in the baby.
- **Tactile barrier and disruption of thermoregulation**. Wearing a swimming cap prevents direct "skin-to-skin" heat transfer between the adult's body and the baby's head, as well as inhibiting the release of oxytocin, a hormone released by the pituitary gland in response to attachment, love and trust (Estapé, p.17, 2021). For a newborn, feeling circular pressure on their skull can trigger a rise in cortisol levels (the stress hormone) and thus associate this emotional and physical sensation with aquatic activity.
- **Basic echolocation**. The baby needs to process how the world sounds both underwater and, on the surface, compare these sounds and their frequencies, and thereby construct

their spatial map (spatial orientation) and the sequence of sounds and actions (temporal orientation).

- **Loss of visual and expressive contact**. Swimming caps sometimes tend to slip down, covering the eyebrows and eyes and pressing against the temples, making it difficult for adults to read the baby's signs of pleasure or displeasure.
- **Unnatural contact and impaired learning of the water-skin relationship**. Due to the large number of nerve receptors in the scalp and the soft, membranous spaces between the bones of the baby's skull (fontanelles), water comes into contact with the baby's head in an unnatural and atypical way, cushioning the impact and altering the baby's subsequent sense of falling and slipping.
- **Altered hydrostatic pressure**. Direct contact between water and the outer ear and the external auditory canal allows for natural pressure regulation. Covering the ears with any material disrupts this natural aquatic regulation.
- **The myth of otitis**. Current medical literature indicates that otitis externa in babies is not usually caused by "clean" swimming pool water, but by moisture retention due to narrow ear canals or aggressive cleaning. A tight-fitting swimming cap can trap moisture and raise the temperature, creating a breeding ground for bacteria.
- **Change in the integration of the tonic labyrinthine reflex** (TLR). Water provides constant feedback to the utricle and saccule of the inner ear, facilitating head control and the stability of the internal cervical musculature.

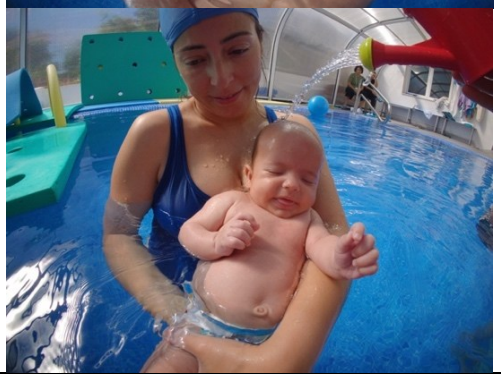
Neurobehavioural and biological benefits of "cephalic nudity"

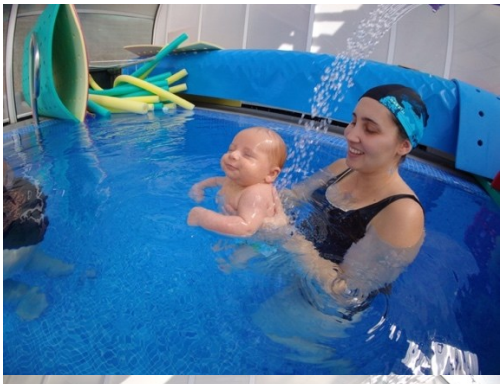
The importance of raising awareness amongst professionals and families about why swimming caps should not be worn by newborns and young babies, and about the benefits that arise when a newborn's head and ear interact freely with water, lies in:

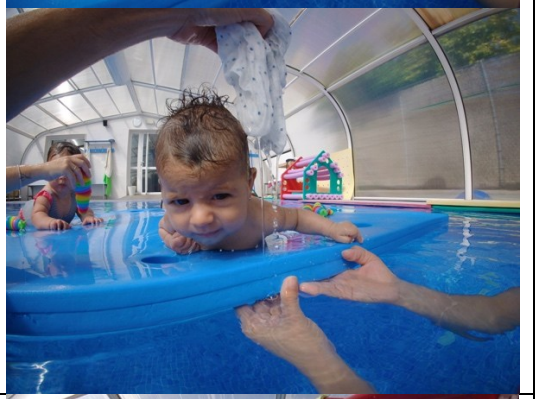
1. **Freedom of the vestibular system**. The inner ear is the centre of balance. Contact between the water and the outer ear allows for genuine proprioception without physical or artificial interference.
2. **Optimisation of the Immersion Reflex**. In newborns, this bradycardic reflex is triggered more naturally when the sensory receptors in the face and head (including the periauricular area) are activated and detect the change in environment, triggering natural responses.
3. **Natural thermoregulation**. The head is the baby's primary means of regulating body temperature. A swimming cap can cause unnecessary overheating in heated water.
4. **Development of the sound map**. The baby needs to learn how sound travels in aquatic and terrestrial environments. Sound waves vibrate and change when they come into contact with water, and the cap acts as an insulator that distorts the baby's ability to echolocate.
5. **Consistent hygiene**. In babies just a few weeks old, the risk of contamination from hair is non-existent or minimal, making the swimming cap a purely aesthetic, normative or commercial accessory, but not a health measure.
6. **Promotion of self-confidence**. By experiencing the water as it is, the child develops a relationship of trust with themselves and the aquatic environment, without artificial barriers.
7. **Holistic sensory integration**. Water is a rich tactile stimulus; covering the ears and head deprives the baby's brain of thousands of synaptic connections per second.

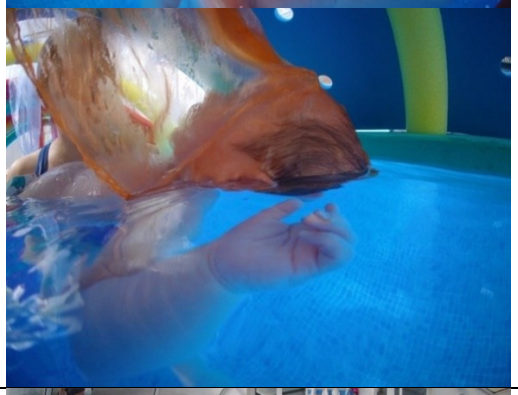
8. **Strengthening of the emotional bond**. In the water, contact between the adult's chest or hands and the baby's head is a source of calm and conveys human warmth and skin-to-skin contact. A swimming cap eliminates this transfer.
9. **Respect for the baby's well-being**. Avoiding the stress caused by putting on such a tight-fitting and often unpleasant garment, whilst respecting the baby's emotional well-being, safety and confidence.

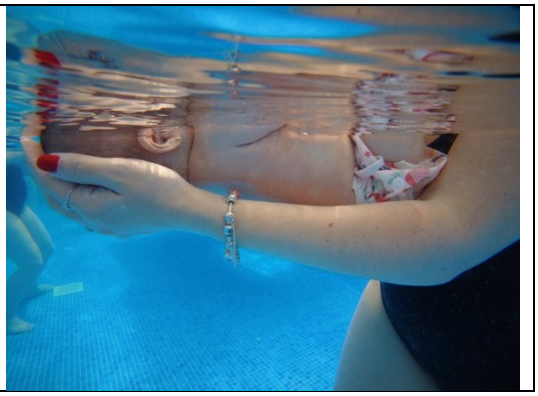
Practical proposal

Activity	Objective	Graphic representation
Hold the baby in a seated position, supporting their body against the adult's, whilst ensuring their neck movements are controlled. Gradually pour water over the baby's head and neck.	Help the baby acclimatise to the aquatic environment. Encourage integration and sensory awareness through contact with water. Foster positive emotions through contact with water.	 
Hold the baby by seating them on the adult's lap or in their hands, with their back resting against the adult's chest. Pour water over the sides of the face, wetting the ears.	Stimulate the sense of hearing and strengthen head control. Promote auditory discrimination on both sides and neck turns to the right and left.	

Hold the baby by the armpits from behind, using your thumbs to prevent any cervical retraction. Allow the baby's limbs to move freely.	Pour water onto the back of the head to encourage neck control, strengthen the neck and back muscles, and stimulate the flexion-extension reflex in the legs.	
Place the baby in a supine position on a floating mat, with their back and body fully supported on the surface and no muscle tension.	Pour water over the sides of the face, wetting the ears to encourage the baby to turn their neck to the right and left. Develop spatial and temporal orientation; relax the facial muscles via the vagus nerve.	

Place the baby in a prone position on a floating mat, supported on their elbows and forearms.	Pour water using your hand or a soaked muslin cloth to enhance right and left-sided coordination. Encourage head turns and improve head control and neck stability.	 
Hold the baby in a sitting position on a floating mat, with their legs dangling in the water. Facing the adult, maintaining eye contact and holding their hands if necessary.	Pour water onto the back of the baby's head to strengthen the back and neck muscles. Promote balance whilst sitting and head control. Encourage neck turns as the water comes into contact with the muscles on the sides of the face.	

Hold the baby in a supine position on the water's surface, cradling them with your hands and the baby's arms whilst a muslin or handkerchief wraps around their head, face and ears.	Gently rock the baby with slow movements to promote relaxation and comfort through contact with the water and the muslin. Strengthen the bond with the primary caregiver and encourage the association of positive emotions and calmness in the water.	 
Cradle the baby with the adult's hands and arms, submerging the ears completely in the water but not the face, whilst maintaining eye contact with the adult.	Gently rock the baby with small movements to the right and left, keeping the ears above the water. Foster a bond of attachment and trust with the adult. Reduce neck tension. Enhance spatial awareness.	

Conclusion

A baby's ears are born knowing how to listen *inside the water*. Putting a cap on them does not protect them; it cuts them off from a skill they have been practising since they were in the womb. A swimming cap for a newborn is not a hygiene measure; it is a sensory blindfold. By leaving the outer ear uncovered, we allow the cerebrospinal fluid and the vestibular system to interact with the density of the water, helping the baby to develop their own sense of balance and head control independently and enjoyably.

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