Oxytocin and human milk

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Short version

It is well known that breastfeeding is associated with oxytocin release in mothers, but the effect of oxytocin in the breastfed infant has been unclear. The infant shows behavioral and physiological effects during breastfeeding that mirror the reaction of the mother to oxytocin, yet infants rarely have a measurable release of oxytocin in their blood circulation during suckling and skin-to-skin contact, unlike the young of other species. It is now more clearly understood that oxytocin can not only be released into the blood circulation, but also directly into regulatory areas of the brain. It now appears likely that the human infant will be exposed to oxytocin within the brain from suckling (stimulating touch receptors in the oral mucosa), from having food in the gastrointestinal tract and from skin-to-skin contact. Therefore, oxytocin plays a key regulatory role for both mother and infant in the development of bonding, interactive behaviors, stress levels and may optimize behavior and physiology of the newborn.

Long version

Oxytocin is a peptide produced in the Supraoptic and Paraventricular nuclei of the hypothalamus. Oxytocin is transported to the posterior pituitary to be released into the blood. In addition neurons extending from the Paraventricular nucleus project to many important regulatory areas in the brain involved in the regulation of social interaction, anxiety and stress levels as well as in the regulation of the activity of the autonomic nervous system.

The human milk contains many different growth factors and it also contains small amounts of oxytocin. Even if the intestinal mucosa is relatively permeable in newborns allowing absorption of the ingested oxytocin, the concentration of oxytocin in the circulation should be minute after having been diluted in the circulating blood volume and further transport into the brain is not likely to occur.

In human mothers oxytocin levels rise in the circulation in response to both suckling and skin to skin contact and an effect spectrum consistent with central release of

oxytocin is induced (stimulation of social interaction, decreased levels of anxiety and stress, decreased levels of sympathetic nervous tone and increased levels of parasympathetic nervous tone).

In calves, dog pups and lambs oxytocin is released into the circulation during suckling and this release is paralleled by a release of oxytocin into the brain. The suckling related release is induced by activation of somatosensory nerves in response to activation of receptors in the oral mucosa and the skin. In human babies circulating oxytocin levels have not been shown to rise during suckling and skin-to-skin contact, but the effect pattern induced mirrors the one induced in the mother in these situations and its therefore likely that oxytocin is released from paraventricular oxytocinergic neurons in the infant's brain, without being reflected by a release of oxytocin into the circulation. In the human infant efferent (outgoing or motor) vagal nerve activity is induced and as a consequence digestive and anabolic functions are optimized.

In addition food intake is linked to a release of the gut hormone cholecystokinin, which in turn stimulates oxytocin release via activation of afferent (ingoing or sensory) vagal nerve fibers. Therefore the ingested milk may also by activation of vagal afferent fibers trigger oxytocin release in the infant's brain and thereby promote interactive behaviours, bonding and regulate stress levels and autonomic nerve function.

In conclusion oxytocin plays an important regulatory role during breastfeeding not only in the mother but also in the infant.