

Comparison of the skin physiology of neonates and young children with that of adults: A randomised clinical trial

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Introduction

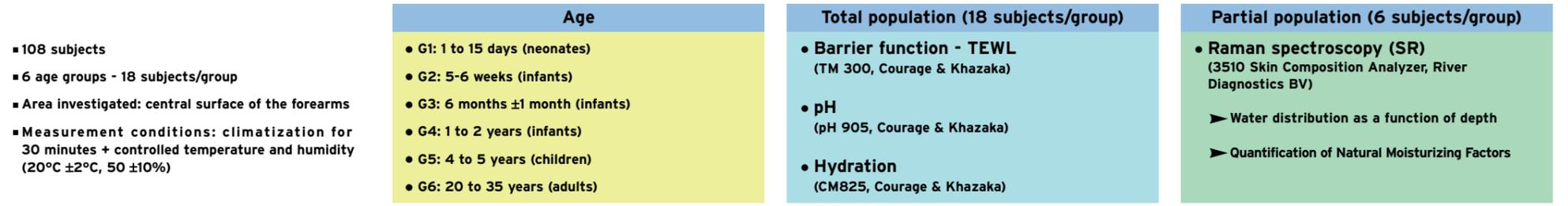
There are anatomical, functional and physiological differences between the skin of neonates and young children and that of adults. These differences are particularly evident in terms of water content, sweating, sensitivity to UV radiation, skin permeability and sensitivity to infection, irritants and certain topical treatments. Using a non-invasive approach, the aim of this study was to explore some of skin's physiological parameters such as transepidermal

water loss (TEWL), *stratum corneum* (SC) moisture levels and surface pH, together with biochemical factors including natural moisturizing factor (NMF) to reach a better understanding of neonatal skin and compare it to that of older children and adults.

Description of the clinical study

The clinical study protocol (figure 1) was submitted to and approved by the Berlin Medical Association Ethics Committee. The study was conducted according to the principles of the Declaration of Helsinki and as per ICH standards

and Good Clinical Practices. The study was carried out between March and September 2009 with an interruption in enrolment in the summer months of July and August.

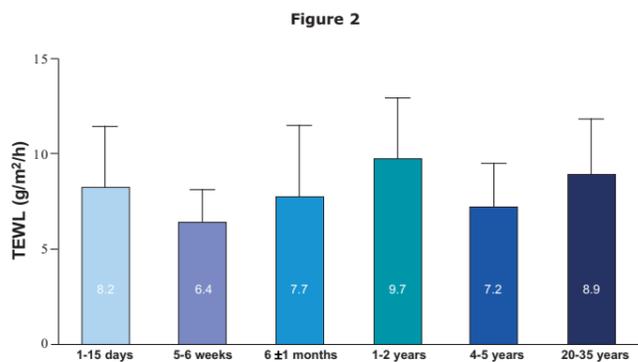


Results

Demographic characteristics of the study population

Group	Subjects included	Age		Weight (kg)		Height (cm)	
		mean (σ)	min-max	mean (σ)	min-max	mean (σ)	min-max
G1	18	4.8 days (4.0)	1 - 14 days	3.2 (0.4)	2 - 4	49.7 (1.9)	47 - 53
G2	18	5.3 weeks (0.49)	5 - 6 weeks	4.6 (0.8)	3 - 6	55.0 (3.3)	48 - 62
G3	18	6.0 months (0.59)	5 - 7 months	7.7 (1.1)	6 - 10	67.4 (4.9)	54 - 77
G4	18	1.2 years (0.43)	1 - 2 years	12.3 (2.1)	9 - 16	87.2 (8.0)	76 - 101
G5	18	4.5 years (0.51)	4 - 5 years	19.5 (2.2)	15 - 24	110.9 (8.0)	101 - 122
G6	18	28.2 years (5.1)	20 - 35 years	67.2 (14.8)	48 - 103	169.4 (8.3)	155 - 185

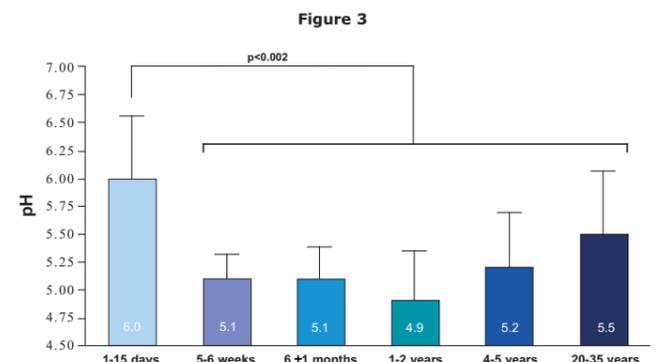
Transepidermal water loss (TEWL) : Measure of skin barrier permeability



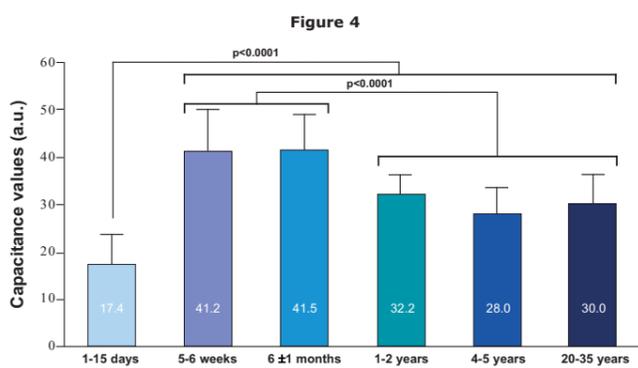
All the mean TEWL values were less than 10g/m²/h, indicating that barrier function was normal and competent in all age groups (figure 2).

Skin pH is higher at birth and decreases by approximately 1 pH unit during the first five weeks of life, reaching values similar to those observed in the other age groups (figure 3). This indicates that pH stabilises rapidly in the first weeks following birth.

Skin pH

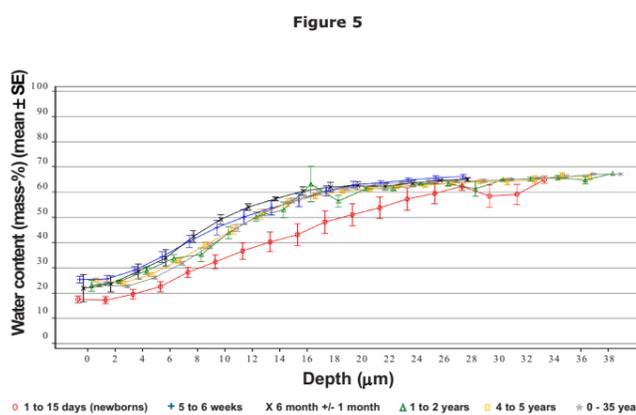


Capacitance



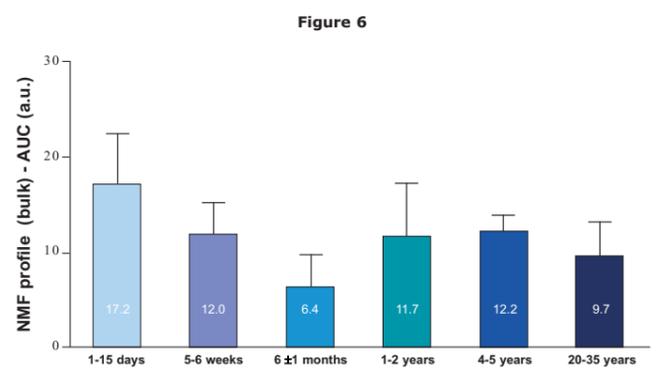
Lowest moisture levels were observed in the neonates (between 1 and 15 days after birth) (figure 4) indicating that neonatal skin tends towards dryness. Five-week old neonates and 6-month old infants presented higher moisture levels versus those observed in the 1-2 year old, 4-5 year old and adult groups.

Water content by RS



Skin water content was found to be lowest in the neonate group (figure 5). With the exception of the neonates, SC water saturation in all groups was approximately 60 % at a skin depth of 15-20 µm. This level of water saturation was observed at between 25-30 µm in the neonate group.

Natural Moisturizing Factors (NMF) by RS



The NMF concentration was higher in the neonate group, particularly at a skin depth of 0-25 µm. The NMF concentration then decreases, with significantly lower concentrations observed in the 6 month old group versus the other age groups (figure 6).

Conclusion

The skin of neonates and infants is generally functional and competent under baseline conditions and our TEWL, pH and water-holding results confirm the findings reported in the literature (Fluhr JW et al., 2010). However, neonatal skin appears slightly less able to absorb water and regulate the mechanisms related to these processes. The decrease in NMFs has already been observed (Nikolovski J et al., 2008) in children aged 3 to 12 months together with higher adsorption/desorption rates than in adults. After birth, it is possible that neonates adapt to the dry environment by compensating for the low moisture levels and high pH of their SC via an increase in the production of NMF.

References

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 J. Nikolovski, GN. Stamatias, N. Kollias, BC. Wiegand. 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(7):1728-36.