

G. SUMMARY

Study on the healthy broiler chicken skin and its alterations under experimental biotin-deficiency

The feathered and unfeathered skin of biotin-supplemented and biotin-deficient chicks of the same age was compared using light- and electron-microscopical methods. Biotin-deficiency was induced by a special diet.

In healthy chicken skin, area-specific epidermal characteristics in keratinization and cornification could be detected, especially regarding the „multigranular bodies“, which are transformed intracellularly into lipid vesicles. The „multigranular bodies“ of the scutate skin contain carbohydrates which are lacking in the feathered skin. Depending on the skin location, the process of releasing the lipids into the intercellular space starts in at different stages of epidermal differentiation. Different amounts of transformed „multigranular body“-material are released, equally depending on the location. Whereas in the epidermis of the metatarsal pad, this process can be already detected in the Stratum transitivum, the initiation of this process is delayed in the feathered skin and in the scutate skin of the dorsal tarsometatarsal area. Large quantities of intracellular lipids are released into the intercellular space in the feathered skin, compared to only small amounts released in the scutate skin. In the mechanically highly strained metatarsal pad, the composition of the „multigranular bodies“ and the time of release of its transformed products result in stronger assembly of bordering horn cells, a thickened epidermis and increased permeability barrier.

The newly hatched chicks which were raised on a biotin-free, avidin-supplemented diet developed typical biotin-deficiency symptoms within three to four weeks. The chicks were in a general bad state of health and showed growth-depression as well as fatty liver degeneration and skin lesions. The chicks which were fed on a biotin-supplemented diet (500 µg/kg) had a good general state of health and healthy skin. Biotin-deficient animals had a decreased liver weight compared to their four biotin-supplemented mates. Plasma and liver biotin contents of biotin-supplemented chicken were many times higher than in the biotin-deficient animals. The four animals fed on a

biotin-free diet without supplementation of the biotin-binding protein avidin also showed low plasma and liver biotin contents, but developed different levels of skin lesions. Corresponding to descriptions in literature, the gravest lesions appeared in the skin of the digits and the metatarsal pad. Additionally, it could be detected that skin regions with soft cornification process were more susceptible than skin areas undergoing a hard cornification process. The well-known skin alterations such as epidermal and dermal hyperplasia described in light-microscopical studies were confirmed by ultrastructural examination. In addition, this study confirmed the loss of carbohydrates in the „multigranular bodies“ of the scutate skin. In the severely damaged suprapapillary epidermis of the metatarsal pad, complete loss of „multigranular bodies“ was verified by electron-microscopical examination. Another interesting result was gained by enzyme-histochemical examination, as adenosintriphosphatase showed decreased activity in the corial capillaries in biotin-deficiency. Ultrastructural examination proved a highly decreased synthesis of keratin filaments and keratin filament bundles in the metatarsal pad, resulting in cessation of cornification in this area. This grave alteration leads to lesions in the Stratum corneum and results in a deficient epidermal mechanical and anti-microbial barrier function for the underlying structures.