

Hydrogen peroxide and monoethanolamine are the key causative ingredients for hair dye-induced dermatitis and hair loss.

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Abstract

BACKGROUND: Hair dyes are being commonly used to change the color of hair for cosmetic reason. However, concern is growing over the dermatitis and subsequent hair loss associated with the repeated use of hair dye products, yet the causative ingredients have not been elucidated.

OBJECTIVE: Here we investigated hair dye-induced dermatitis and hair loss using in vivo mouse model to uncover the causative ingredients.

METHODS: Commercially available hair dye products or combination of the ingredients of hair dye product were applied topically for 3 days on the dorsum of the female C57BL/6 mice and, dermatitis and hair loss were examined.

RESULTS: The mice treated with hair dye products exhibited unequivocal signs of hair loss and dermatitis. To find out causative ingredients, combinations of the representative components of hair dye including reducing agents, the mixture of dye and monoethanolamine (MEA), ammonia, and hydrogen peroxide (H₂O₂) were applied and thereafter, hair loss and dermatitis were evaluated. All the groups treated with the combinations containing H₂O₂ and neutralized dye mixture manifested hair loss and dermatitis.

Subsequent experiments revealed that H₂O₂ and MEA synergistically induced hair loss and dermatitis.

Histological examination showed that oxidative stress may be the mechanism underlying hair-dye induced dermatitis. Consistently, H₂O₂ and MEA synergistically induced oxidative stress and cytotoxicity in human keratinocytes.

CONCLUSION: These results suggest that H₂O₂ and MEA may be the key causative ingredients for hair dye-associated dermatitis and hair loss.