

Skin care at strong sweat formation*

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Sweat glands are high-performance glands. They become active when the body's surface temperature needs to be cooled down, or in other words, whenever the body temperature rises and the temperature has to be dissipated quickly, or if the heat dissipation of the body is not sufficiently ensured in the case of high outdoor temperatures. In both cases the high evaporative cooling of water is utilized – only 1 g of sweat (about 99 % of water) eliminates about 600 calories out of the body surface and the surrounding air during evaporation.

Sweat is the physiological emergency brake whenever there is a risk that the body becomes too warm. This emergency brake works on an individual pace. Some people tend to sweat more easily while others perspire less frequently. The cooling efficiency not only depends on the physical constitution but also on the surface of the sweat droplets. The smaller the droplet the larger is the evaporative surface area and hence the more efficient is the cooling.

A lake of sweat forms...

When the droplets flow together and form a continuous film ("lake of sweat"), surface and hence cooling efficiency are reduced. Even if the sweat glands work at their utmost limit due to the overheated body, the cooling efficiency also has reached its limit.

A film of sweat forms particularly fast on areas with many sweat glands and on spots where hairs are missing, have been removed or have been lost due to androgenetical causes:

- front and scalp (in the case of alopecia)
- armpits (shaving or epilation)
- genital and anal area (shaving or epilation)
- nipples
- foot soles and palms

Footwear and tight clothing additionally create occlusive conditions i.e. the water vapour cannot escape. In this case, the body cannot be cooled and the moisture on the body surface is uncomfortable. Occlusive conditions also occur if armpits, genital and anal areas have been shaved. This is due to the fact that hairs efficiently dissipate sweat, increase the evaporation surface and form a breathable separating layer between the contacting skin areas.

Although contradictory to today's understanding of hygiene and fashion, people suffering from hidrosis are recommended to abstain

from shaving the genital and armpit areas. Also tight clothing and closed shoes should be avoided.

Numerous causes of hyperhidrosis

Simple words of advice only are a small relief for individuals suffering from a pronounced hyperhidrosis though. Besides a normal thermoregulation of the body, additional factors are involved such as

- **Phobia like affects:** Confined spaces along with the apprehension of possible sweat attacks and the fear that surrounding people might notice their sweating already will increase the adrenalin due to negative experiences before. This leads to stress situations, the body temperature rises and the sweat glands start to work.
- **Stress and mental problems** can wake you up at night soaked with sweat. However, if nightly sweating is not only a temporary condition but appears continuously it is recommended to consult a doctor in order to find the potential disease behind the sweat attacks.
- **Clammy hands and "cold" sweat** are disagreeable side effects of exam anxiety and nervousness before job interviews.
- **Hormonal changes** such as puberty and menopause are frequent causes for an augmented tendency to sweating.
- **Increased body temperature** due to feverish infections may cause hyperhidrosis which however will gradually ease along with the improving health condition.
- **Food:** beverages with caffeine, hot spices and sumptuous meals increase the problem. Alcohol also is rather unfavourable.
- **Physically demanding activities** and high body weight.

A medical exam to exclude potential underlying diseases, dysfunctions of body organs but also

side effects of pharmaceuticals (e.g. of parasympathomimetics) is indispensable before taking steps against profuse sweating. Psychotherapeutic advice, autogenous training and progressive muscle relaxation¹ can individually be efficient measures if emotional excitement, claustrophobia, haptophobia or similar strains are involved.

Glands with different functionality

The human body is equipped with two different kinds of sweat glands. The eccrine sweat glands serve for thermoregulation and are distributed over the whole body while front, palms and the foot soles are specifically replete with. The sweat fluid contains, among other substances, sodium chloride (common salt), urea, uric acid, antimicrobial peptides (dermicidin²) and fatty acids. The fatty acids determine the low pH level of the skin surface. If the evaporating sweat concentrates and forms crusts of salt it may cause irritations on sensitive skin.

Depending on the sex, the apocrine sweat glands ("scent glands") in armpits, genital and anal areas secrete androstenone (metabolic product of testosterone), isovaleric acid and branched, partly unsaturated C₆-C₁₁-acids in varying concentrations. Along with the products of bacterial decomposition they locally determine the individual body odour, similar to the nipples.

Treatment and active agents

Regarding the treatment of hyperhidrosis³ which can appear on specific parts of the body (focal hyperhidrosis) or all over the body (generalized hyperhidrosis) it is rather secondary whether it is a matter of eccrine or apocrine sweat glands. Aluminium chlorohydrate still is the most important and most efficient active agent. It reacts with mucopolysaccharides and proteins and occludes the eccrine gland exits like a plug. The higher the concentration and the lower the pH level of the preparations, the more efficient they are, although the risk of developing irritations will increase too. The preparations should be applied some

time in advance as they are not too efficient in acute cases due to the fact that the already started sweat secretion impedes the penetration of the active agent into the gland exits. The daily application at the beginning of the treatment can gradually be reduced to one application per week. In many cases the treatment interval can even be extended.

For quite some time now the sales promotion of deodorants has changed to aluminum-free preparations as aluminum has been reported to increase the risk of Alzheimer and breast cancer (in women). Also the media picked up on the issue⁴ and have discussed it over and over. These assumptions however still lack solid evidence. The studies presented so far have been contradictory.⁵ Individuals suffering from hyperhidrosis have no alternative to aluminum containing preparations since deodorants without aluminium chlorohydrate work less efficient. The Federal Institute for Risk Assessment (BfR) recommends not to apply aluminium chlorohydrate immediately after shaving resp. on disordered armpit skin in order to reduce the individual absorption of aluminum.⁵ Alum (INCI: Potassium Aluminium Sulfate or Potassium Alum) as substitute works like aluminium chlorohydrate. Advertising with "0% Aluminium Chlorohydrate" suggests a product free of aluminum which is not the case.

An embarrassing side effect of sweating is the intensified body odour due to the activity of the apocrine glands and the modified body flora. Hence many deodorants contain essential oils in order to cover the body odour. It should be mentioned though that they frequently are counterproductive due to the naturally occurring allergenic components. Less appropriate in this context also are alcohol denatured with diethyl phthalate (INCI: Alcohol denat)⁶ and non-biodegradable silicones⁷. More beneficial are bactericidal and antiseptic additives. Bactericidal chlorophenol derivatives such as triclosan and 2,2'-Methylenebis(3,4,6-trichlorophenol) alias hexachloro dihydroxydiphenyl methane are suspected of being hazardous but still are used as ingredients. In general, all the

¹ E. Hofmann, Progressive Muskelentspannung, ein Trainingsprogramm. Verlag Hogrefe, Göttingen 2003

² S. Feil: Gezinkte Abwehr: Antimikrobieller Schweiß, Chemie in unserer Zeit. 46 (3), 135 (2012)

³ Leitlinie Definition und Therapie der primären Hyperhidrose der Deutschen Dermatologische Gesellschaft, AWMF online

⁴ Die Akte Aluminium, TV movie by Bert Ehgartner

⁵ Stellungnahme Nr. 007/2014 des Bundesinstituts für Risikobewertung (BfR), vom 26. Februar 2014

⁶ H. Lautenschläger, Vergällungsmittel in Kosmetika - Gesundheit ist zweitrangig, Kosmetische Praxis 2009 (5), 10-13

⁷ H. Lautenschläger, Silizium - Global Player der Kosmetik, Kosmetische Praxis 2010 (6), 12-15

bactericidal preservatives listed in the appendix of the Cosmetic Directive can be found in the preparations. Less efficient alternatives are farnesol and particular glycerine esters. Substances that can denature peptides respectively proteins have antiseptic effects. Among them are

- **Aluminium chlorohydrate** (see above)
- **Hexamethylenetetramine** alias **Methenamine** (INCI) has antimicrobial and antiseptic effects. Its reaction with proteins results from the elimination of formaldehyde in the acidic milieu of the skin.
- **Tannins** (polyphenolic gallic acid esters) from vegetable sources are widely used. The phenolic groups of the tannins condense with proteins and form complex macro molecules. Typical representatives are birch and oak bark extracts as well as gallic acid and their derivatives. Their dark colour can be a disadvantage though. Other extracts such as e.g. witch hazel extract also contain astringent tannins.

Further beneficial substances

Sage extract contains tannins and has astringent effects however the sweat suppressing effect also is due to other components. It can be used in the form of teas or deodorants although it only has limited effects in cases of a profuse hyperhidrosis. Valerian and St. John's wort preparations have soothing and sedating effects in the case of psychogenic sweat attacks; more effective psychotropic drugs and sedatives are used in the medical context.

Since the sweat formation is controlled by the messenger substance acetylcholine, anticholinergics such as glycopyrronium bromide (free base: glycopyrrolate), methanthelinium bromide and bornaprine are pharmaceutically administered for oral application (glycopyrronium bromide also topical). Experts however hold differing views as to the respective results. In analogy, the intracutaneously applied botulinum toxin also affects the acetylcholine-dependent nerves of the sweat glands.

Concluding, the potential treatments with local iontophoresis (treatment with direct current) and surgical measures as a last resort should also be mentioned.

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