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# SKIN ANALYSIS

## A Practical Guide

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### KEY FACTS 5: Alpha and Beta Hydroxyacids and other acids

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# SO YOU WANT THE SCIENCE?

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## ALPHA AND BETA HYDROXYACIDS & OTHER ACIDS

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Alpha Hydroxyacids (AHA's) have had the popular limelight as great cosmeceuticals for many years. I believe their benefits are best achieved together **with topical vitamin A**. The same is true for Beta hydroxyacids (BHA) but they each have specific effects that are good for skin.

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“ THE AHA'S ARE ACTIVE COSMECEUTIC INGREDIENTS THAT GENERALLY ARE NOT INTENDED FOR YOUNGER PEOPLE **WITH HEALTHY SKIN**, AND SHOULD ONLY BE USED FROM ABOUT THE AGE OF 25 YEARS UPWARDS FOR PHOTOAGING. ”

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When young people have acne or some other problem of excessive keratinisation then AHA's and BHA's can be very effective.

## VARIOUS TYPES OF AHA'S

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Glycolic and lactic acid are the most commonly used ingredients in cosmetics, but many cosmetic houses claim to have special acids found in various fruits like strawberries, etc. **Another marketing claim that should be clearly understood, is that glycolic acid used in all cosmetics (even so-called natural products) is not natural**, but is synthesised in a laboratory. Lactic acid is generally 'synthesised but nature-identical'. Use only natural (but synthesised) lactic acids. They have the correct 'rotation' to fit with our natural receptors.

All of the carboxylic acids (carbon, oxygen and hydrogen) are acids (COOH) with an attached hydroxyl group (OH). When the OH group is situated on the alpha carbon, then the acid effect is weaker than when the OH is situated on the beta position. The presence of this hydroxy group “softens” the effects of the acid that would otherwise be too strong or even poisonous. The softening effects are mediated through complex electrical events involving electrons that defuse the power of the acid radical. Beta hydroxyacids are stronger acids because there is less “softening” of the acid ending of the molecule by the hydroxyl group on a more distant carbon atom. This ending of the acid chain is the only common feature of the Alpha Hydroxyacids and the other part of the acid may be quite variable. That is why some of the acids are very short and have a low molecular weight, whereas others are much longer and have a higher molecular weight.

There is a lot of publicity about the use of AHA's. **Some people believe that AHA's make radical changes to the skin and can be used by themselves year after year with no ill effect to the skin, but this is not true.**

Some people say that the AHA's have to be at a certain pH and of at least a certain minimum strength. Again, this has to be understood from a chemical point of view. **The lower the pH, the more effective the AHA is, but it is also more corrosive.** At approximately pH 3.5 one has adequate AHA activity and good safety. At pH 4.5 one still has reasonable but gentle acid activity and even greater safety. The higher the pH, the safer the product becomes, however, at pH over 6 there is minimal acidity and detectable improvement in skin.

## HOW ALPHA HYDROXYACIDS WORK

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**1 The most obvious effect is that they promote natural desquamation (exfoliation of the dead and dying cells) of the horny layer of the skin.** They dissolve the alkaline desmosomes bonds (i.e. "the cement" or glue) between these cells. This allows the cells to flake off evenly and at a faster rate. The cells beneath are "newer" (but remember that they are still "dead" cells), fresher and less dehydrated. This gives a softer and smoother appearance to the skin. AHA's also compact the horny layer. Desquamation may continue for up to 2 weeks after stopping the use of AHA products.

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**2 AHA's like glycolic and lactic acid promote growth of the basal layer cells.** They do, however, seem to promote healthier cells and part of this action may be due to the fact that unhealthy cells are less acid resistant and are selectively removed while the healthier cells resist the acid and they multiply and take over the place of the unhealthy cells. I believe that the acidity stimulates the release of growth factors through stressing the cells in the same way as the response to heat and other noxious events (1).

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**3 Healthier skin becomes more waterproof, and so dry skin conditions are relieved.** However, paradoxically, prolonged use of AHA's may aggravate dry skin because of damage to the horny layer (2, 3).

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**4 In many cases, irregular pigmentation of the skin can be diminished but this effect may not be as strong as it is with the addition of vitamin A.** The reason is also different. Vitamin A has effects on the manufacture of melanin whereas the AHA's act only by chemical action on melanin in the keratinocytes. The melanin bleaches from dark brown or black to a lighter colour because of the low pH (4).

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5 **The AHA's penetrate, to some degree, into the sebaceous follicle where the build-up of dead cells is associated with acne conditions.** The AHAs remove dead cells, thereby “un-blocking” the follicle and preventing a build-up (5).

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6 **The initial improved moisturisation extends down into the dermis and the skin gets better turgor so wrinkles are less obvious.** AHAs and specifically lactic acid, promote glycosaminoglycans in the dermis, which adds to the water retention properties of the skin (6, 7).

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7 There are also effects on the fibroblast cells, which produce more hydroxyproline, an essential amino acid that is a precursor to collagen; more collagen is laid down (8, 9).

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8 Because of the physical effect of stinging the skin, AHAs may also improve the blood flow to the skin (10).

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9 Some carboxylic acids are antioxidants (e.g. polyhydroxyacids, ascorbic acid).

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You'll notice that many of these effects are very similar to the effects caused by vitamin A and some people believe that AHAs are an alternative to vitamin A. Strangely enough, vitamin A acid is a carboxylic acid! **Vitamin A works on different receptors and has its main effects on the DNA whereas AHAs work at other, as yet undetermined, sites.** The fact that they work in two different places is a good reason for combining them to get the best effects. **AHA treated skin is photosensitive and must be protected from the sun (3).**

Natural lactic acid stings less than synthetic lactic acid and significantly less than glycolic acid (11). Why this is so, is not understood.

Natural lactic acid has an important function in reducing pigmentation by suppressing the formation of tyrosinase (12). It works well with other tyrosinase inhibitors like vitamin C. It is also anti-microbial, and as such, is a natural preservative.

In summary, lactic acid is a natural component of skin and has special properties:

- It is a powerful humectant.
- Lactic acid is an important and major part of the natural moisturising factors.
- It produces all the typical advantages of AHA's.
- It assists in maintaining the natural acid mantle.
- Lactic acid is an important skin-lightening ingredient.
- It is safe – even to eat – and has no negative impact on the environment.

**I believe that the combination of cosmetic vitamin A together with AHA's probably form the most important ingredients in skin-care, and are effective to help control ageing skin.** These two important ingredients, however, cannot be presented in the same cream without sacrificing the activity of one or the other group. Vitamin A is destroyed at the pH that is required for AHA activity. The AHA's don't work at the pH that safeguards the vitamin A. The AHA's have a very low pH and work optimally at or below pH 4.5. At pH 6 the AHA's have negligible effects. Vitamin A is destabilised at below about pH 5.5. Paradoxically, one can safely mix the two creams in one's hand and make a mixture that will be effective because the mixture is used immediately.

## THE SIDE EFFECTS OF ALPHA HYDROXYACIDS

There are, fortunately, few side effects:

- 1 Stinging on application.
- 2 Redness in the early stages or if the preparation is applied too thickly.
- 3 Flaking of the skin, usually only in the early stages.
- 4 Some skins may develop spots within the first 1 or 2 weeks.
- 5 These effects should not be interpreted as signs that the client is too sensitive for AHA's. However, problems will disappear once the complexion adjusts.
- 6 Prolonged use of AHA's without vitamin A support will eventually cause dry skin problems. This is the result of chronic stripping of the horny layer. This effect is similar to chronic mechanical abrasion of the surface of the skin.

## SENSITIVE SKIN AND ALPHA HYDROXYACIDS

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AHA's are usually well tolerated by people with sensitive skins and in people who seem to react to other creams. **They are very useful in acne because they increase the acidity of the skin, reduce the build-up of the horny layer which clogs the ducts of the sebaceous glands and removes plugs – whiteheads / blackheads.** AHA's can be used in people with couperose (broken veins) and rosacea.

## HOW TO USE ALPHA HYDROXYACIDS

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People's skins **are different**. Some skins will respond to rather low doses, whereas others require much higher concentrations. Very broadly speaking, AHA cosmetic effects are usually created at concentrations above 3.5 %.

Use AHA's with the following general guidelines:

- 1 Transient stinging almost always occurs when they are applied especially if one has done "cosmetic" stratum corneum needling . This is normal and is not a reason for concern.
- 2 Start on a low level to get effects without irritation of the skin. After an interval of weeks or months, the skin will tolerate a higher dose.
- 3 Always combine AHA with vitamin A products.

**The AHA's also have a place in body treatment where one can achieve a silky surface in people with rough skin.** Lactic acid is most effective in treating rough and dry skin conditions. Neutralised lactic acid (e.g. ammonium lactate) seems to be particularly active in softening calloused skin.

## BETA HYDROXYACIDS

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Beta hydroxyacids (BHA's), like alpha hydroxyacids, are derived from plants, fruit, and gluconamide, a sugar derivative. **BHA's break-up the bonds (desmosomes) between the dead cells of the horny layer.** This facilitates exfoliation and allows new skin cells to emerge. Another important effect is that the horny layer becomes more permeable and agents can penetrate more easily through this lipid barrier.

Beta hydroxyacids in the form of salicylic acid, and citric acid, have been used to treat a variety of human diseases; either orally or topically for centuries. Synthetic salicylic acid has been studied for a long time, and it is well known for its keratolytic action (13).

**Salicylic acid removes excess horny layer very efficiently and can penetrate down into the depths of the epidermis.** In fact, salicylic acid can reach right into the dermis and can be absorbed into the blood stream (14). **Its main historical reasons for application are to treat acne (15), solar keratoses and thickened rough skin.** Many clinicians noted that skin appeared 'fresher' after applying salicylic acid to the face and neck, and so salicylic acid was recognised for reversing aging skin. The skin became thicker with increased amounts of glycosaminoglycans.

**Acne and aged skin are not harmed by repeated applications of salicylic acid in low doses.** At about 2% to 4% SA (salicylic acid) there is no danger of adverse systemic effects. However, at much higher doses e.g. 20% there is a risk of salicylic acid intoxication.

## BHA FOR PHOTO-AGING

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**Dr. Albert Kligman believed, and I also believe, that beta hydroxyacids have better potential for treating photo-aging than alpha hydroxyacids.**

They do things that alpha hydroxyacids cannot. One of those things is that a beta hydroxyacid like salicylic acid can help to treat pathological sugar deposits (glycation) in cells which are a feature of ageing. That is why, for those who can, it is also a good idea to take a half tablet of aspirin every day! Not everyone can do that because in some people they might bleed excessively

The exfoliation properties of salicylic acid that result in increased cell turnover and new cell production are not the only reasons for its ability to reverse pre-mature aging. It has been suggested that physiological changes occur and amongst other things, Tumour Necrosing Factor  $\alpha$  (TNF- $\alpha$ ) is promoted and that then mediates the changes in the skin (16, 17).

**Increased collagen synthesis, as has been shown with alpha hydroxyacids, also occurs with beta hydroxyacids (18).** As a result, thin lines and wrinkles are reduced: the underlying new cells and new collagen production in the dermal layers, expands skin tissues and results in firmer, smoother looking skin.

## BETA HYDROXYACIDS FOR ACNE

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**It has been known for years that salicylic acid penetrates through sebum; the substance produced by sebaceous glands.** People with oily skins have more active sebaceous glands, and sebum can become mixed and hardened with the horny layer lining the follicles or "pores." This obstructs the follicle and leads to acne. Salicylic acid and other BHA's can reverse this by dissolving these keratin plugs (19). Salicylic acid has the unique property of penetrating though pores, eliminating acne-causing bacteria, and helping to restore the irritated skin surrounding the pore. Salicylic acid lowers the pH and inhibits the growth of bacteria on the surface of the skin as well as in the follicles.

## SIDE EFFECTS OF BETA HYDROXYACIDS

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At high doses (20% and higher, salicylism (intoxication by salicylic acid) with ringing ears, nausea and vomiting may occur because salicylic acid penetrates the skin so effectively.

In a study of side effects caused by hydroxyacids, salicylic acid caused virtually no irritation compared to glycolic acid, the popular AHA, which can often cause stinging and burning sensations (20). Salicylic acid has superior exfoliating benefits versus glycolic acid, and it's gentler to the skin (21). Long term use of salicylic acid does not eventually lead to dehydrated skin as often happens with the un-remitting use of AHA's.

**As with Alpha Hydroxyacids, one should avoid sun exposure when using a beta hydroxyacid. It is critical to protect the skin from UV-A when using a beta hydroxyacid.**

**BEWARE! AVOID EXPOSURE TO SUN ESPECIALLY IN PIGMENTATION PROBLEMS.** It is critical to protect the skin with greater care particularly from UV-A when using AHA's (3). Thus I advocate AHA usage at night. Sometimes one can use AHA's for several months as a way to stimulate growth factors but always protect the skin from UV light with vitamin A, antioxidants and sunscreens. Remember that AHA's are valuable, but need to be used sensibly.



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