Natural antiperspirants: dream or reality?

Philip B Klepak - Independent Consultant, US
Barbara M Schmidt PhD, Independent Consultant - US

In recent years, some products of plant origin have been shown to be effective chemotherapeutic agents demonstrating measureable biological activity without exerting undesirable side effects. This article addresses whether some plants contain sufficient bioactive phtyochemicals that could function as 'natural' antiperspirants when applied from a topical formulation.

The terms antiperspirant and deodorant are often used interchangeably in publications, but this is confusing, as there are true differences between them, especially with respect to regulatory classification, functionality, and the types of ingredients currently used. The first step, therefore, is to briefly understand the current state of the art.

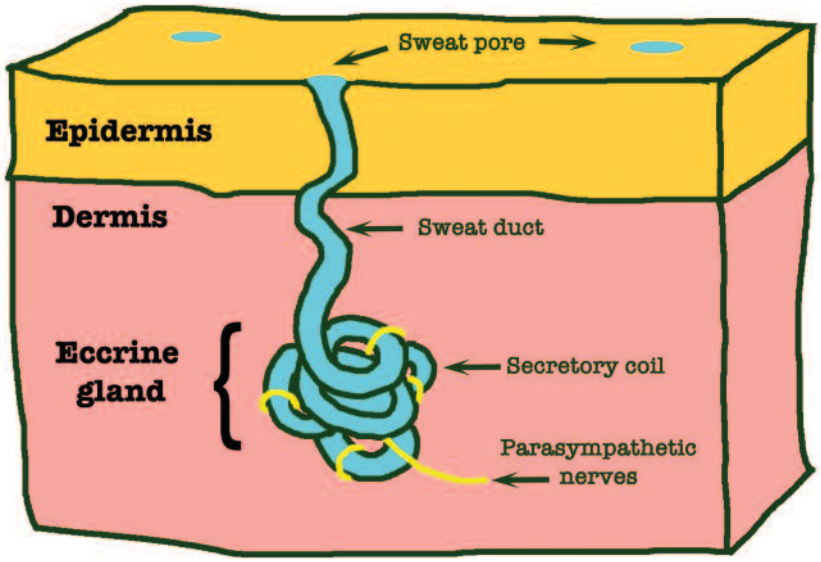


Figure 1: Schematic of eccrine sweat gland.

Antiperspirants versus deodorants

In the US, antiperspirants are classified as over-the-counter (OTC) drugs. The Food and Drug Administration (FDA) defines a drug as "an article intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease and/or an article (other than food) intended to affect the structure or function of the human body and/or an article intended for use as a component of such an article." Antiperspirants reduce underarm sweating/wetness by forming temporary superficial plugs in the sweat glands thereby decreasing the amount of sweat that reaches the skin surface. As sweating is a bodily function, antiperspirants conform to the definition of a drug product. The only currently approved active ingredients for antiperspirants are aluminium or aluminium zirconium-based metallic salts.

In contrast, deodorants are classified as cosmetics in the US. The Food, Drug, and Cosmetic (FD&C) Act defines cosmetics as "articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body…for cleansing, beautifying, promoting attractiveness, or altering the appearance." Deodorants are one of the product classes included in this definition, as they are formulated to neutralise or mask underarm odour caused by the bacterial breakdown of perspiration. They do not reduce sweating. A large variety of ingredients are used in deodorants including but not limited to fragrances, antimicrobial agents, baking soda, natural essential oils, astringents, zinc oxide (ZnO), chelating agents, etc.

True antiperspirants also act as deodorants because they exert antimicrobial activity against odour causing microorganisms, and they reduce perspiration, which is necessary for the proliferation of bacteria that cause underarm odour.

Outside the US, antiperspirants are primarily regulated as cosmetics.

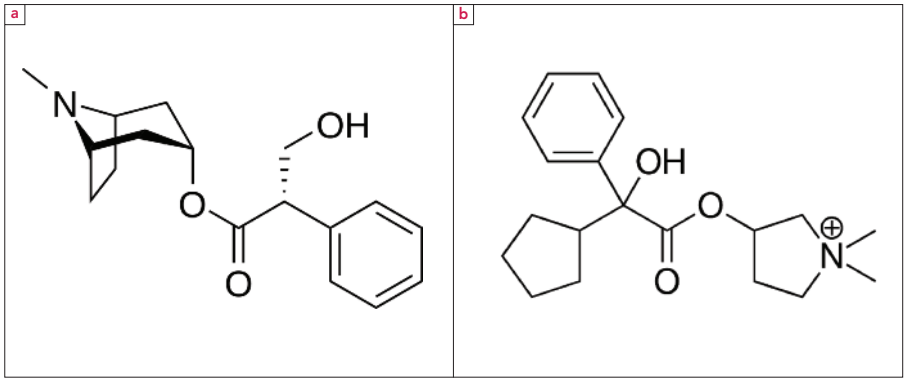
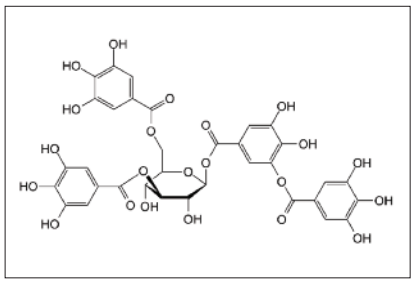
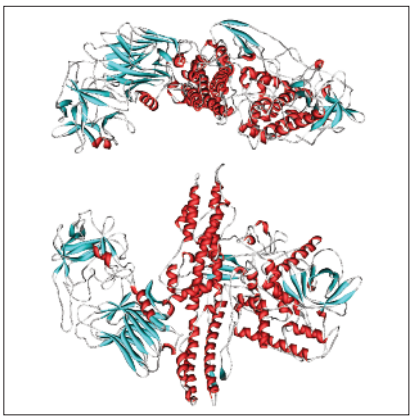


Figure 2: A. Hyoscyamine, a tropane alkaloid with anticholinergic activity from the plant family Solanaceae. B. Glycopyrrolate, a synthetic anticholinergic drug approved by the FDA as a topical wipe to treat excessive underarm sweating.



Tannins

Witch Hazel



Botox (onabotulinum toxin A)

Milkvetch

Arrowroot starch

Halloysite

Figure 3: Examples of antiperspirant ingredients from nature.

Bioactivities

Before discussing active phytochemicals in detail for application as antiperspirants, let us briefly review the other categories of ingredients that are used in underarm products, antiperspirants or deodorants, to better understand what they actually do.

Aluminium and aluminium-zirconium - based salts

These drug actives function by superficial plugging of the eccrine sweat gland ducts (Fig 1) in the stratum corneum layer of the skin by an aluminum hydroxide gel. Due to their acidic nature, the aluminum salts diffuse into the sweat ducts and then proteins in the duct are aggregated by the hydrolyzed aluminium polycations. Per the FDA, these actives must reduce perspiration output by a minimum of 20% to be labelled as antiperspirants, and they can be promoted as "extra effective" if they reduce perspiration by a minimum of 30%. This is demonstrated in hot room clinical testing. Clinical Strength products are an industry developed category, and these products, due to the active type and concentrations used, have been demonstrated to achieve higher sweat reductions, sometimes up to about 60%.

Astringents

These materials are used in cosmetics to cause contraction/shrinkage/tightening of the skin and skin pores, and some also provide antibacterial benefits. It is believed that certain types of these agents, such as tannic acid, formaldehyde, and glutaraldehyde, can denature proteins in the stratum corneum lining the sweat glands which results in a partial closure of the sweat duct. Some sweat testing was done in the past on palm and plantar surfaces, but positive clinical benefits for axillary sweating were never demonstrated. Today, these kinds of agents are considered obsolete. More acceptable cosmetic grade astringents, such as witch hazel, calendula, specific essential oils, sage, and black tea, can currently be found in underarm deodorants, but no therapeutic benefits have been established.

Absorbents

In general, these are substances used to absorb hydrosoluble, dissolved liposoluble, or finely dispersed substances. They are used in a wide variety of cosmetic products to reportedly absorb moisture, sebum, skin oils, etc., and some powders due to their porous nature reportedly can adsorb odour molecules. Common cosmetic grade absorbents found in underarm deodorants include activated charcoal, arrowroot powder, corn starch, kaolin clay, bentonite, talc, magnesium oxide (MgO), and ZnO. In the last few years, at least a dozen stick deodorants have been introduced in the market that contain one or more of these absorbents. Published, scientifically supported evidence that these deodorants absorb sweat or odour molecules is generally lacking. In the early 1990s, Elida Gibbs (Unilever) test marketed Kyomi Deodorant-Antiperspirant that contained a superabsorbent cellulose powder, but the product was not successful in the market for aesthetic and other reasons.

Decreased sweat stimulation

One way to decrease sweating is to target the parasympathetic nervous system. This is a useful tactic for people that have excessive sweating (hyperhidrosis) on the face, feet, or hands. Oral anticholinergics are sometimes prescribed for people that suffer from hyperhidrosis who have failed to respond to other antiperspirant treatments. For example, diphemanil methylsulfate is an anticholinergic that has been formulated as both an oral and topical drug for hyperhidrosis. Topical anticholinergics generally have less undesirable side effects than oral and they can be used to treat sweating only in the problem areas. In 2004, the US FDA approved Botox® (onabotulinum toxin A) injections for the treatment of severe primary axillary hyperhidrosis. The toxin binds to receptors located on the presynaptic membrane of axons, temporarily blocking the release of acetylcholine.[1] This prevents the hyperstimulation of eccrine sweat glands (Fig 1). In 2018, the FDA approved Qbrexza (glycopyrronium cloth, 2.4%, for topical use)

as an anticholinergic drug for primary axillary hyperhidrosis (Fig 2). In plants, tropane alkaloids from the family Solanaceae have well-documented anticholinergic activity and are used as pharmaceuticals for a range of conditions. Examples include atropine, hyoscyamine (Fig 2), and scopolamine.

Protein aggregation

Disulfide bonds and non-covalent interactions help stabilise proteins in their native state. Changes to these non-covalent interactions can destabilise the protein structure, leaving it susceptible to misfolding or unfolding. Protein aggregation can occur as a result of misfolding, resulting in a large macromolecular structure. Sweat collected at the skin surface is mainly composed of water containing sodium chloride and a low concentration of proteins and solutes. Aluminum chlorohydrate (ACH) is capable of causing protein aggregation, which may be one of its mechanisms of action. In experiments with natural and artificial sweat, Bretagne *et al*.[2] determined the presence of proteins was essential for sweat pore plug formation when using a typical ACH antiperspirant formula. Using micro-focused X ray scattering, they found sweat plugs were composed of ACH and proteins. When they removed proteins from the artificial sweat, plugs did not form. They concluded a reaction between highly ionic aluminum polycations and sweat proteins caused the aggregation and plug formation. Although plant natural products do not have the same ionic properties as aluminum salts, many are capable of interacting with proteins, causing misfolding and aggregation. For example, tannins (Fig 3) derived from tree bark have been used commercially to tan leather through their protein binding, precipitating, and cross-linking properties. They are also used commercially as coagulants and flocculants, aggregating proteins and other organic compounds for easier removal from liquids such as beer and wastewater.

Ingredients from nature

In recent years, there has been a global uptick in products marketed as 'natural antiperspirants' with an array of plant-based ingredients. Some of the most common ingredients include aloe, various plant starches, green tea, and plants with essential oils like members of the mint (Lamiaceae) and citrus (Rutaceae) families, lemongrass (*Cymbopogon citratus*), tea tree oil (*Melaleuca alternifolia*), and sandalwood (*Santalum album*). From a scientific standpoint, none of these ingredients have been reported as clinically effective antiperspirants, although many are antibacterial, have a pleasing fragrance, and could potentially absorb sweat in the case of plant starches. In ethnobotanical literature, there are a number of plants, fungi, and minerals prescribed as antiperspirants. This is especially true in Traditional Chinese Medicine (TCM) and Ayurveda.

Table 1: Ayurvedic herbs for sweating[2-4]

Latin name	Common name	Family	Part
Cedrus deodara	Himalayan cedar	Pinaceae	Bark, oil, leaves, resin
Chrysopogon zizanioides	Vetiver	Poaceae	Root
Curcuma caesia	Black turmeric	Zingiberaceae	Tuber
Cyperus rotundus	Nut grass	Cyperaceae	Tuber
Jasminum auriculatum	Indian Jui, Jasmine	Oleaceae	Flower, root, leaf
Acacia catechu	Khadira	Fabaceae	Bark and wood
Areca catechu	Betel nut	Arecaceae	Fruit
Glycyrrhiza glabra	Licorice	Fabaceae	Root
Hemidesmus indicus	Indian sarsaparilla	Apocynaceae	Root
Nardostachys jatamansi	Spikenard	Caprifoliaceae	Root
Pavonia odorata	Fragrant swamp mallow	Malvaceae	Root
Phyllanthus emblica	Indian gooseberry	Phyllanthaceae	Fruit
Sida cordifolia	Bala	Malvaceae	Seeds, leaves, root
Symplocos racemosa	Lodhra	Symplocaceae	Bark

Table 2: TCM herbs for sweating[5-10]

Latin name	Common name	Family	Part
Acorus spp.	Sweet flag	Acoraceae	Stems, leaves
Agastache spp.	Hyssop	Lamiaceae	Stems, leaves
Angelica dahurica	Dahurian angelica	Apiaceae	Root
Artemisia spp.	Wormwood	Asteraceae	Stems, leaves
Astragalus propinquus	Milkvetch, Huáng Qí	Fabaceae	Root
Coptis chinensis	Golden thread	Ranunculaceae	Rhizome
Ephedra sinica	Ephedra	Ephedraceae	Root
Eupatorium fortunei	Fortune eupatorium	Asteraceae	Stems, leaves
Fraxinus chinensis subsp. *rhynchophylla*	Ash tree	Oleaceae	Leaves
Morus spp.	Mulberry	Moraceae	Leaves
Nardostachys jatamansi	Chinese Nardostachys	Caprifoliaceae	Root
Nepeta spp.	Japanese catnip	Lamiaceae	Stems, leaves
Portulaca spp.	Purslane	Portulacaceae	Stems, leaves
Pueraria montana var. *lobata*	Kudzu	Fabaceae	Root
Syzygium aromaticum	Clove	Myrtaceae	Flower

Ingredients from plants

In both TCM and Ayurveda, there are numerous oral remedies for sweating caused by a systemic 'imbalance', stress, obesity, or illness like malaria or tuberculosis. There are far fewer topical formulations for everyday sweating or hyperhidrosis. One published study tested a product made from five Ayurvedic herbs (first five herbs listed in Table 1) traditionally used for the control of foot odour and excessive sweating.[3] Fifty subjects applied

the product twice daily for 15 days to the right foot with the left foot acting as untreated control. While this was not a gold-standard clinical trial, the authors suggest these Ayurvedic herbs may have clinical effectiveness against bad foot odour, sweating, and itching. One thing these herbs have in common is the presence of essential oils containing terpenes. Terpenes generally have a pleasing odour and antimicrobial properties. They certainly could account for a perceived benefit against foot odour and perhaps itching of they treated a fungal infection. A paste made from *Vetiveria zizanioides* is listed in the Ayurvedic herbal Dravyaguna Vijnana[4] and Charaka Samhita[5] as a topical treatment for excessive sweating and associated body odour. Several other Ayurvedic herbs prescribed for excessive sweating are listed in Table 1. They contain an array of phytochemicals including terpenes, tannins, saponins, and alkaloids.

In TCM, excessive underarm sweating can be a sign of heat accumulation, sometimes attributed to poor diet, overwork, lack of sleep, or organ weakness. As such, prescribed treatments are often taken orally to target systemic problems and to restore harmony within the body. Ephedra Radix (*Ephedra sinica* root) is an oral TCM treatment for hyperhidrosis. In a mouse sweating model, oral administration of an isolated fraction from Ephedra containing the polyphenol mahuannin B was effective against hyperhidrosis.[6] Radix Astragali, also called Huang Qi, is the dried roots of Astragalus propinquus (syn. *Astragalus membranaceus* var. mongholicus). This TCM herb is also used as an oral antiperspirant.[7,8] Topical TCM herbs used to wash and dry the armpits, control bacteria, and to help arrest underarm sweating are listed in Table 2. Many are fragrant herbs and spices such as clove (Fig 4), sweet flag, Japanese catnip, and wormwood. They are sometimes mixed with alum (a hydrated double sulfate salt of aluminum) or other minerals. Leung et al.[9] found an aqueous extract of mulberry leaves and ash tree bark (Qin Pi) used as a 15-minute foot soak reduced foot sweating by an average of 15% in a pilot study with twenty healthy volunteers. These herbs have cooling properties in TCM and are also antibacterial, which could help reduce foot odour.

In Europe and the Americas, a number of herbal remedies have been traditionally used as underarm and foot antiperspirants (Table 3). In North America, the Navajos used rough cocklebur (*Xanthium strumarium*) liniment as an underarm antiperspirant.[12] In Italy, common yarrow (*Achillea millefolium*) and soapwort (*Saponaria officinalis*) flowers mixed with water are applied topically, acting as topical demulcents or film-formers.[13] In Kosovo, people use aerial parts of sage (*Salvia officinalis*) and flowers of elderberry (*Sambucus nigra*) as antiperspirants.[14] East Mediterranean sage (*Salvia libanotica*) essential oil from leaf water extracts has been used as a topical antiperspirant in Lebanon.[15] Fresh leaves of rockrose (*Cistus ladanifer*) were used as a foot antiperspirant in Portugal.[16] Aerial parts of horsetail (*Equisetum arvense*) were used traditionally for foot hyperhidrosis in Eastern Europe.[17] Similar to TCM, *Astragalus* spp. have been used in traditional Palestinian medicine as an antiperspirant.[18] It has antibacterial and antioxidant properties, but no clinical trials have been performed to prove its efficacy as an antiperspirant. Flavonoids, phenolic acids, and saponins are considered as the main active components contributing to Astragalus's therapeutic effects in traditional medicine.

In addition to plants, fungi and marine creatures have been used as traditional antiperspirants. In Eastern Europe, dried fruiting bodies of the fungus *Laricifomes officinalis* (known as conks of larch and Apothekerschwamm) were taken orally as an antiperspirant and for night sweats related to fever and tuberculosis.[19] In Ancient Greece, eggs from the common sea urchin *Paracentrotus lividus* were used for a range of skin disorders and as an antiperspirant.[20]

Table 3: European and American herbs, fungi, and marine organisms for sweating.[12-20]

Latin name	Common name	Family	Part
Achillea millefolium	Yarrow	Asteraceae	Flowers
Astragalus spp.	Milkvetch	Fabaceae	Root
Cistus ladanifer	Rockrose	Cistaceae	Leaves
Equisetum arvense	Horsetail	Equisetaceae	Stems, leaves
Salvia fruticosa	East Mediterranean sage	Lamiaceae	Stems, leaves
Salvia officinalis	Sage	Lamiaceae	Stems, leaves
Sambucus nigra	Elderberry	Adoxaceae	Flowers
Saponaria officinalis	Soapwort	Caryophyllaceae	Flowers
Xanthium strumarium	Cocklebur	Asteraceae	Unknown
Laricifomes officinalis	Conk fungi	Fomitopsidaceae	Fruit
Paracentrotus lividus	Purple sea urchin	Parechinidae	Eggs

Mineral ingredients

You can find an array of minerals from natural sources in modern antiperspirants such as alum and sea salts containing magnesium. Alum is regularly mentioned as an antiperspirant in traditional medicine including TCM[10] and in Iraq.[21] In TCM, bone powder, ground seashells, and halloysite (an aluminosilicate clay mineral) are applied as sweat absorbers, sometimes in conjunction with herbs.[10]

Research and development challenges of a natural antiperspirant

Formulation technology

The amount of technical support, and the types of safety and efficacy data available for natural formulations can range from solid scientific studies, anecdotal home remedies, and/or support from other industries such as food. For a natural antiperspirant, performance support should be based on actual clinical efficacy testing of the final product formulation for the specific claim of "reduces underarm sweating" or a related claim. This means that the natural extract should not be added at a non-functional level, but rather, should be tested at the level required to demonstrate the intended claim. The performance target can be either to meet or exceed the minimum quantitative FDA standard using their statistical criterion, or to demonstrate a statistically significant sweat reduction benefit versus a placebo. Efficacy will be addressed in more detail later in this article.

In addition to functional performance, other parameters that should be investigated are stability/shelf life, colour, odour, preservation, sensory characteristics, etc.

Some pitfalls that should be recognised and considered up front and factored into the R&D plan are as follows:

- Natural extracts may not be as effective as the aluminum-based salts. Our evidence from pilot studies suggests this is the case (data not published).
- The supply of natural extracts could be inconsistent, in that there are variations in the technical specifications based on sources of supply. This could require repeated and extended quality

controls, and/or establishing a standardised phytochemical profile.
- It may be harder to work with natural extracts. For example, are they prone to contamination (e.g. metals, allergens)? Do they present preservation concerns? In contrast, the current aluminum-based formulations are generally considered to be self-preserved.
- Formulations containing natural extracts could have a shorter shelf-life due to degradation of the active component overtime. It may be appropriate to identify and follow several marker compounds to track stability.

Ingredient sourcing, quality assurance, and consistency

Some advantages to the FDA's regulatory control over antiperspirant ingredients are quality assurance of ingredients and final formulations along with clear labelling of active ingredient concentration. With botanical natural products, the same regulatory assurances are not in place. From a consumer standpoint, they cannot determine how much lemongrass oil is used in a lemongrass antiperspirant, as this level of labelling transparency is not required. They also do not know where the lemongrass oil came from or its clinical efficacy. It is a 'buyer beware' marketplace. The same is largely true for antiperspirant manufacturers when it comes to botanical ingredient sourcing. Although manufacturers control the concentration of ingredients in their final formula and may test for clinical efficacy, the botanical ingredient supply chain is opaque. Botanical suppliers (plant raw material or plant extract supplier) must be chosen carefully to assure supply chain transparency and batch-to-batch consistency. Ingredient adulteration, inhumane labour practices, and environmental injustices are common in the botanical industry. Ethical issues can lead to legal pitfalls when international or federal laws are broken or when consumer safety is compromised. Problems with batch-to-batch inconsistency can produce ingredients that lack efficacy, have off-odours, or off-colours. The latter two issues can have an immediate negative, perceptible effect on a formula, especially if the ingredient is used at high concentrations. For many types of cosmetics, botanical 'actives' are added in very low concentrations and efficacy is not immediate (e.g. anti-ageing creams). The same is not true for natural antiperspirants. If the product is not effective, a consumer will know when they start to sweat. In this product category, ingredient quality control is of high importance.

Plant extract stability–powders vs. liquids

Liquid botanical ingredients contain a botanical extract mixed in solvents like glycerin and glycols. These botanical liquids are easy to formulate with, as they do not require a lot of work to dissolve and incorporate into the formula. Two big disadvantages are limits on concentration and shelf stability. Liquid formulations usually contain only 1-10% plant extract in a liquid carrier. If your final antiperspirant formula requires 5% plant extract for efficacy, this may not be achievable with dilute liquids. Many natural products are easily oxidised, especially at room temperature in the presence of water, alcohols, or other solvents. A reduction in efficacy may precede any perceptible change in colour or odour. We have observed significant, rapid degradation of phytochemicals in plant extracts when stored in a liquid or cream base. In contrast, we found dry extracts from the same plants retained their phytochemical integrity and clinical antiperspirant efficacy for 18-24 months at room temperature (unpublished data).

The method used to dry plant extracts

has a large impact on quality. The industry uses a range of drying technologies to produce plant extracts including spray, drum, tray, oven, microwave, and freeze-drying. In general, higher drying temperatures and longer exposure to heat increase oxidisation. Colour and odour of the dry extract largely depends on the extraction process, plant species, and plant part. However, brown to black extracts are an indicator of oxidation, especially if light coloured batches were previously produced. Excipients like starches or minerals may be added to dry extracts to reduce caking, but a high concentration of excipient can limit the amount of extract that can be added to formulas, just like liquid extract carriers. Also, we have observed a reduction in phytochemical yield (unpublished data) in the presence of certain 'inert' excipients, possibly due to irreversible adsorption or other chemical interactions.[22] One significant hurdle of using dry extracts is difficult dissolution. Experimental trial and error is required to find the optimal solvents, heat, and agitation for dissolution.

Figure 4: Cloves (Syzygium aromaticum), a commonly adulterated fragrant spice crop used as a traditional antiperspirant ingredient (Photograph by Jorge Barrios, 2007).

Antiperspirant formulation: stability and colour

Many cosmetic chemists are aware of the unique challenge posed by natural products in cosmetic formulations. High batch temperatures must be avoided to reduce phytochemical degradation. When using waxes that require high melting temperatures, the extracts could be incorporated at the end of the batch, after the temperature has dropped. Even after extracts or pure phytochemicals are fully dissolved and incorporated into the formula, they can precipitate once the batch cools or after a longer period of time. They can cause an emulsion to split over time or lose viscosity. They can react with packaging and frequently change the formula colour from light to brown. Although stability problems can be anticipated, there is not always an easy way to avoid the problem. A rigorous experimental process is usually required to find a formula that optimises both phytochemical and formula stability. Since most plant extracts are coloured, a pure white formula may not be possible without sacrificing clinical efficacy or formula sensory quality. Many consumers are wiling to adjust their expectations for formula aesthetics when purchasing a natural formula, as evidenced by the numerous green, yellow, beige, and other colours of skin creams on the market.

Efficacy testing

As already mentioned, since antiperspirants are intended to reduce sweat production in the underarms, several clinical study approaches are available, including the similar protocols recommended by the FDA (USA) and Clearcast (UK). These protocols are gravimetric methods as they quantify the actual amount of eccrine sweat produced in the underarms during specific time intervals and under controlled conditions. In summary, after a washout period of at least 17 days in which no antiperspirant is used, baseline sweat collections are obtained from the panelists in a controlled environment hot room, and those panellists that qualify are then treated with the test product under one axilla for typically three or four consecutive days. The other axilla serves as an untreated control, or a placebo can be used as the control product. Hot room sweat challenge is then repeated 24 hours after the last product application. The pre and post sweat collection data are then assessed statistically using the Wilcoxon signed rank test to determine sweat reduction effectiveness. These protocols establish that the formulation meets the statutory definition of an antiperspirant.

Other, more sophisticated testing options are also possible depending on how much claim support is desired or considered realistic for the product. For example, longer duration of efficacy, physical activity resistance, psychological stress protection, extreme heat resistance, night sweats, etc.

There is virtually no reliable animal or *in vitro* test method for antiperspirant efficacy testing, which is a major hurdle to research and development. Therefore, the standard approach is *in vivo* testing performed on the body site where the product is intended to be applied. The gravimetric method is the most widely used option, particularly when quantitative sweat collections are used to measure sweat reductions.

In general, the variability of antiperspirant clinical study results is increasing, and the reasons are not fully understood at present. Based on our knowledge and testing of natural extracts, they will exhibit less efficacy than the aluminum-based salts. So it is important to ensure that their wetness reduction performance can be measured with statistical confidence. Also, assessing small amounts of sweat at weak excretion rates is difficult, and requires experimental skill. Therefore, the following is recommended in order to design and conduct a successful clinical test of natural extracts:

- Make sure that the baseline sweating values in both armpits are similar and not skewed. A minimum of 100 mgs per armpit is often used, and it is recommended that the spread between the lowest and highest sweaters is at least 600 mgs.
- Panellists should not be enrolled if they have a history of being pro-perspirers, i.e., sweating more after product treatment.

- The mean and median sweat reduction values should be close, as a relatively large difference could indicate something wrong with the study.
- An effective product should work on both men and women, but mixed gender test panels are not recommended so as to avoid any questionable results due to surface area and sweat volume differences. In general female panellists are used.
- Statistics experts indicate that you need about a 28% arithmetical sweat reduction with 30 - 35 panellists to pass the FDA Monograph statistical performance criterion. The Clearcast protocol recommends 50 panellists. However, it should be remembered that there are no other quantitative standards for antiperspirant performance ex US and UK. So if your product reduces perspiration statistically better than a control, you can label your product an antiperspirant. In the US, antiperspirant claims are restricted to FDA OTC monograph ingredients only.

Marketing in a crowded field

The global underarm products market (antiperspirants and deodorants) is healthy and growing. The growth is fuelled by the youth population, and the key factors that are currently driving the market are increasing concern about hygiene among consumers, changing lifestyles which includes daily grooming routines, increasing disposable income resulting in discretionary toiletry products becoming necessities for daily use, and innovations in new formats and ingredients. While the North American and European markets currently exhibit the highest demand, many other countries and cultures are adopting the changes. As examples, Eastern Europe is the growth engine in Europe, and India is the fastest growing market in Asia due to increasing westernisation and male grooming trends. Per Statista, the global compound annual growth rate (CAGR) for this category over the next five years is projected to be in the range of about 4% – 6%. Current global penetration of underarm products is about 70%, so it is not yet fully mature. This also supports the high growth potential of the category.

A concurrent global trend in the cosmetics market in general is the rising consumer awareness of natural ingredients with therapeutic or biological effects. This is combined by consumers with an association of possible side effects derived from some of the chemical and synthetic ingredients in antiperspirants. This is a key challenge faced by the market.

The safety of aluminum salts is under increasing scrutiny[23] even though the links to breast cancer and Alzheimer's disease are not generally accepted in the scientific and medical communities, and some studies are even discredited. This continued negative pressure about the effects of aluminium-based antiperspirants on health is contributing to a growing consumer demand for natural antiperspirant ingredients and formulations specifically for sticks, creams, and emulsions.

We know that consumer belief and perception is often very different, and we know from interviews that many consumers would willingly purchase a 'natural' antiperspirant at a premium price even with only a modest sweat reduction activity.

Already there is some initial reporting that aluminum could be restricted in some countries in Western Europe, particularly France and the Nordic countries to start. Given the anticipated regulatory restrictions on aluminum salts, consumer demand for natural antiperspirants, and ethnobotanical knowledge of several herbs used as topical antiperspirants, more resources should be devoted to identifying potential antiperspirant ingredients from natural sources and verifying their clinical efficacy. Once potential candidates have been identified, challenges such as reliable ingredient sourcing, formulation, and stability can be overcome with dedicated R&D investment. PC

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