

# ESSENTIAL OILS THEIR LACK OF SKIN ABSORPTION, BUT EFFECTIVENESS VIA INHALATION.

By Martin Watt

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Note: An extra article has been added [at the foot](#) of this one.

## **Introduction to the article:**

I am anxious that people do not misconstrue my articles as indicating that I don't think aromatherapy works. This is far from the truth as I wholeheartedly agree the therapy can have wonderful healing benefits. However, I am certain some of the traditionally held views on how it works are misleading.

Please also take note of the original date of this article. In the intervening years I have only heard of one recent and as yet unpublished research project, where adequate methods have been used to prevent the inhalation of the oil vapours. Preliminary results indicate no skin absorption.

## **Aromatherapy can be a potent tool for:**

- Unlocking the brains inhibition of normal bodily processes caused by various emotional factors.
- It is excellent for giving relief from many musculo-skeletal ailments.
- Essential oils can achieve spectacular results when treating various kinds of skin trauma.

However, much confusion and misinformation exists about two relatively separate forms of treatment:-

- 1) massage.
- 2) The use of aromatic oils with or without massage.

## **Therapeutic activity:**

Some of the aromatic 'essential' oils used in aromatherapy do have well-documented therapeutic actions. However, many of the oils for which aromatherapists claim physiological medical activity, in fact possess no recorded historical medicinal actions. Oils such as: Moroccan chamomile, Citronella, Clary sage, Geranium, Rosewood, Vetiver and Ylang were originally produced solely for the perfumery and fragrance trades.

On the other hand, certain oils such as aniseed, cubeb, dill, fennel, peppermint, rose, sandalwood, etc. have been used over several hundred years for a variety of ailments. However, such oils were mainly used internally as medicinal agents. The vast majority of reports within aromatherapy about therapeutic activity are based on information gleaned from the ORAL consumption of herbal remedies which differ a lot from essential oils.

Most aromatherapists claim explicit physical effects after massaging with oils, for example: "Fennel is diuretic," "Geranium regulates the hormonal system," "Grapefruit is good for cellulite." However, **none of these effects have been proven when these oils are applied to the skin during massage.**

One example of the misleading hype is found with Fennel oil. It is well known for producing an increase in urine output when it is taken as a medicine. However, when the volume of fennel oil used in the average massage is applied, it is doubtful that enough can be absorbed through the skin to elicit any such diuretic action. If very large amounts are used on the skin, or it is occluded - such as with compresses - or the essential oil is used in hot humid environments, then I am prepared to accept some oil may get into the subcutaneous tissues. Diuresis has though been proven to occur following ordinary massage without the use of any essential oils. [\(1\)](#)

### I believe the modes of action of essential oils used in aromatherapy are:

1. The psychotherapeutic effects of the oils on the olfactory system and the brain.
2. The absorption into the circulation of some of the oils constituent chemicals via the nasal membranes and lungs.
3. For muscular problems; if much higher percentages of essential oil than are normally used in massage are 'rubbed in' or applied on compresses.
4. Damaged skin can often benefit from using 'healing' essential and fixed oils. This form of treatment may not be strictly 'aromatherapy', but it is closely allied. This is because the essential oils can have a **direct** pharmacological action on damaged tissues, as well as **indirect** beneficial effects on the mind if the aroma is perceived as pleasant.

### The effects of essential oils on the brain via the olfactory system:

This is the basis on which the perfumery trade functions, and is the way I believe most aromatherapy works. The fragrance trades have sponsored substantial research on the psychological effects of aromatic substances. It has been clearly demonstrated in animals and humans that brain wave patterns are affected to quite a remarkable degree when aromatic vapours are inhaled. It has even been shown that brain wave patterns are altered, when human subjects inhaled aromatic vapours at such a low level that they said: "they could not smell the substance that was being administered." This experiment in particular clearly demonstrates that the human sense of smell is much more acute than it is normally credited with.

Perfume manufacturers have based their business around the effects that certain perfumes can have on the emotional state of both the wearer and people they come into contact with. Therefore, businesses that worldwide are worth billions of dollars, are largely based on the psychological and emotional effects of fragrance. It is therefore somewhat peculiar that this most important aspect of the use of fragrant plant oils, is not the linchpin of aromatherapy. Rather, most courses insist on dogmatically sticking to the hypothesis that the oils achieve a pharmacological effect by being absorbed through the skin and into the circulation - a fundamentally flawed concept

### Skin absorption of essential oils:

I remain extremely sceptical that this is a route by which significant volumes of most essential oils can enter the body. After years of looking at so called 'scientific' research, I have failed to find one trial where the methodology used has been adequate [\(2\)](#). Generally researchers have taken no precautions to prevent the inhalation of the volatile molecules. This is the critically important area that I have found time and time again being overlooked by researchers. They always fail to understand the fundamental nature of most essential oils, which is that they are **extremely volatile** substances. As such, they quickly find their way into the respiratory tract epithelium and thence to the bloodstream.

Currently a lot of **theoretical skin biology** is being taught in aromatherapy courses. Most tuition is based on theoretical models of how essential oils may be metabolised once they have gained access to the layers of skin where enzymatic reactions are known to occur. As a small number of drugs are now administered in the form of skin patches, this is promoted as being "conclusive

evidence" that essential oils are freely absorbed in a similar manner. Yet, even hormone patches require the solution of the hormones in alcohol or other solvents in order to permit their absorption.

**Scientific references supplied by various authors about 'evidence of skin absorption' frequently refer to experiments of little relevance to aromatherapy such as:**

1. Individual fragrance chemicals (usually synthetic) are used - not the WHOLE oil with its hundreds of different chemicals. [\(3\)](#).
2. The substance being tested has often been applied under occlusion (covered) [\(4\)](#), which **does** force the substance into the skin. However, this ignores the fact that when essential oils are used in massage, body heat will quickly evaporate the vast majority of the highly volatile chemicals away from the skin, thus permitting quick inhalation.

The use of a vegetable carrier oil probably makes little difference to the amount of essential oil absorbed by the skin. This is because the volatile chemicals in essential oils evaporate within seconds of application to a warm area. Also, the rate of evaporation from the skin is likely to be substantially enhanced by the heat generated by the massage. I have to remind you that even when using carrier oils you can quickly smell the essential oils used. The mere fact that you can smell them means the vapours are gaining immediate access to the respiratory tract.

3. Of Major importance, is the most fundamental error of all research that I have come across which is that **inadequate precautions have been taken to prevent inhalation of the essential oil vapours**. I have read all of the paper published by Rommelt et al. in 1974 [\(5\)](#). However in the oft quoted 1974 paper, aromatherapy writers and some scientists, simply overlook the fact that **150 ml. of a Pine bath oil** was added to the bath of the subject, and no mention was made of how he breathed. It does not surprise me that he excreted a-b-pinene and camphene for several days. How on earth can anyone compare the effects of 150 mls. with the few drops of essential oils used in the average massage.

This team published a subsequent paper [\(10\)](#) on absorption of essential oil compounds from a bath, but this time inhibiting breathing of the vapours. They subsequently detected fragrance chemicals in the blood. However the use of essential oils in a bath is nothing like the same as their use in aromatherapy massage. In the presence of heat and more importantly humidity, the skin will absorb compounds. Again in this experiment far larger volumes of oil seem to have been used than are used in massage.

The same researchers indicated there might be some absorption of essential oils from ointments. Indeed, there may be a little absorption by this method, but I do not know if the inhalation factor was excluded in any trials. Ointments have an extremely ancient history of being used as local applications for musculo-skeletal problems, **but there is little sound data suggesting that the volume of essential oils so absorbed, can have anything other than a localised effect.**

I am not aware of any evidence suggesting that enough essential oil is left in the bloodstream to have any effects on other organs. Until experiments are conducted with the people being massaged having an air supply under pressure and from a remote source, then all these tests are unreliable. Interestingly no one in complementary medicine seems interested in sponsoring such a simple trial, I wonder why?

4. In fact, there is far more evidence to support the opposing view, which is that most essential oils are **NOT FREELY ABSORBED**. Human skin seems to more readily permit the absorption of a number of water soluble plant chemicals such as the nicotine anti-smoking patches - nicotine being a water soluble alkaloid unrelated to essential oils. Many National pharmacopoeias contain formulations for lotions, creams and ointments for painful conditions such as sciatica, neuralgia & arthritis based on water soluble plant alkaloids. There is however little evidence to support the theory that human skin will readily permit the passage of the lipid (fat) soluble portions of plants - barring a few exceptions. In traditional medicine we find few examples of plant oils being used for anything other

than localised treatments. Fixed and volatile plant oils have always been used principally for cosmetic and skin care purposes.

Of utmost importance, is not if essential oils are absorbed into the superficial dead layers of the skin, as clearly this does occur. But, does sufficient find its way into the body via the skin to have any clinical effects? My investigations of dermatological literature have led me to the following conclusion: When a few natural chemicals in essential oils are absorbed by the skin, with a few exceptions, it is found that those same essential oils are well documented as causing adverse dermal and systemic reactions. This seems to me to indicate that many essential oils are alien to the immune system when they are taken into the body via the skin.

### **I offer the following evidence on skin absorption or the lack of it:**

The monographs published by the R.I.F.M. provide the following unless indicated. There is insufficient space to give full references, but they are available in their monographs. I must add here, that even where absorption of volatile chemicals has been indicated, without exclusion of the inhalation factor the results must still remain questionable.

**Note on the chemicals below:** Frequently these are lab grade synthetic chemicals. Absorption tests are via the skin of animals, but of note is that human skin is far less permeable than animal skin.

#### CHEMICALS - ABSORBED:

Benzyl acetate, benzoic acid, camphor, d-carvone, cinnamic acid, coumarin, para-cymene, d-limonene, methyl salicylate, a-phellandrene, terpineol, a -b -pinene & camphene.

With d-limonene only 3% was absorbed in vitro across isolated human skin, while in rats the figure was 6%. (6). Note: One probably gets higher levels of d-limonene in the blood from eating orange flavoured drinks, candies, cakes, liqueurs, etc.

#### CHEMICALS - NOT ABSORBED:

linalool within 2 hours of application. (7) \*\*\*

d-pulegone in pennyroyal.

carvacrol in some thymes and mints.

eugenol, isoeugenol & methyl benzoate in clove, tuberose and ylang.

fenchone in anise, fennel & some lavenders.

geraniol in geranium & palmarosa.

#### WHOLE ESSENTIAL OILS - ABSORBED:

Cumin, Tansy.

#### WHOLE ESSENTIAL OILS - NOT ABSORBED:

Lavender (\*\*see reference above on linalool), Tolu balsam oil, Copaiba balsam oil, Parsley seed, Patchouli, Pimenta berry and leaf.

### **The absorption of aromatic molecules via the nasal passages and lungs:**

This method by which aromatic molecules in essential oils gain access to the body has been demonstrated: Rosemary oil vapours were introduced into the atmosphere of caged mice. It was shown that their blood contained a substantial proportion of one of the chemicals present in the inhaled essential oil. This proved the volatile chemicals in essential oils can gain access to the bloodstream in significant amounts if the concentration in the atmosphere is at an appreciable level. (9).

**UPDATE:** Since the time of writing, trials on humans have confirmed that indeed, significant volume of essential oils do gain access to the blood via the respiratory tract.

As the brain is a 'blood hungry' organ then clearly the first port of call for aromatic molecules absorbed via the olfactory epithelium is likely to be the brain. It is of course well known that certain drugs are known to act extremely quickly when they are sniffed up the nose.

### **CONCLUSION:**

I believe it is likely that we get a complexity of effects when essential oils are **inhaled**:

- 1) A direct pharmacological effect via the blood supply to the brain.
- 2) An indirect effect via the olfactory nerve pathways to the brain.
- 3) The beneficial effects from the massage and the touch receptors.
- 4) The **powerful placebo effect**, caused by client therapist interactions.
- 5) Possibly, a regulation of energy flows via similar pathways to accupressure/acupuncture.

With that kind of bombardment, it's not surprising that aromatherapy can achieve such excellent results. The therapy is clearly potent at reducing the brains capacity to inhibit the body from carrying out its routine regulating and healing activities.

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## **Cutaneous Absorption (or the lack of) of Essential Oils**

by Sylla Sheppard Hanger and Martin Watt

This article was sent to the International Journal of Aromatherapy in April 1995 **but was never published**. It is a little dated but most points are still as valid today. At a later date, other articles by other authors, suddenly started questioning the concept of skin absorption!!

## Do essential oils penetrate the skin into the bloodstream?

This is a very confusing issue in the aromatherapy literature as most sources say the skin readily absorbs essential oils into the bloodstream and this is the route by which significant volumes of oils can enter the body. They say this is not only because the skin is the largest organ, but also because some essential oils are extremely lipophilic in nature, and the molecular structure of essential oils is very small.

Research has proven the penetration ability of several drugs now administered in the form of patches, and it is assumed that essential oils are similarly absorbed. However, by investigating a wide range of dermatological literature, one can find much more evidence to support the opposite view. Whole essential oils are **not freely absorbed** and very few essential oil constituents are absorbed through the skin into the bloodstream. Most chemical constituents would be absorbed into the circulation in reasonably significant amounts via nasal membranes and lungs if the concentration in the atmosphere is at an appreciable level.

Human skin has developed as a highly effective barrier. Little evidence shows, with a few exceptions, that the skin will readily admit lipid soluble portions of plants. Almost without exception (an exception may be chamazulene), the small number of natural chemicals present in essential oils which are slightly absorbed by the skin, are also well documented as causing adverse dermal reactions. This would seem to indicate that a wide range of essential oils are **alien to the immune system when taken into the body via the skin**. Nevertheless, the important question remains whether sufficient quantities enter the body through the skin to have any beneficial pharmacological effects. And, yes, in spite of this, aromatherapy still works! It is just the method it is assumed it works by is not correct. Certainly it works symptomatically by external application on superficial skin layers (i.e., as antiseptic, anti-inflammatory, etc.) and more importantly in some cases, via the mind.

Based on theoretical models of how the skin is constructed and of how it should work, it is assumed that essential oils can pass through this tough barrier. Yet, skin absorption of whole essential oils has not been definitely shown. It is assumed, at least in theory that substances with low molecular weight will penetrate the skin. Essential oils and their naturally occurring constituents are mostly below 1000 m (m = molecular weight). It is also said that "due to their lipophilic nature", some essential oils and vegetable oils have an affinity to the skin, thereby allowing their passage into the bloodstream. It is also said that "due to this lipophilic nature, essential oils are soluble in fat and some fat-dissolving oils (high in ketones) are said to be able to dissolve the myelin sheath around nerves promoting "neuro"-toxicity".

First of all, if essential oils managed to get into living cells in sufficient quantity to dissolve the fat then it would certainly also kill the cell(s). The test of putting a drop of thuja on chicken fat and seeing it dissolve (as advocated by some) is not considered "proof" and cannot at all be compared to use in aromatherapy (at least any more than watching a drop of lavender eat a hole in a styrofoam cup).

Citing patch medications and garlic applied to the feet (then detecting on breath) is also incorrect as evidence of penetration through the skin. Application of occluded concentrated chemicals cannot be compared to essential oil application in aromatherapy. And garlic has a chemical composition totally different to any other essential oil. Because of its fantastic volatility, inhalation is impossible to avoid (most people have to leave the room when a bottle is opened). Yes the oil gets in the body, but by being inhaled and then excreted on the breath for hours afterwards. In spite of all this, there remains no substantial evidence of whole essential oils having been detected in the bloodstream in clinically active amounts following skin application.

Secondly, we use carrier oils for skin application; the molecules of vegetable oils are much larger than essential oils, and in spite of their lipophilic nature, are also unable to pass through the skin [\(1\)](#). The theoretical model advocated is that skin is relatively permeable to fat soluble molecules and impermeable to water and salts; and because cell membranes have a lipid bilayer, it seems

possible that fat soluble molecules can pass through. However, most vegetable oils (including essential oils contained within them) have been found to reside in the outer dead layer of skin without penetrating into the bloodstream. In addition, viscosity or degree of saturation of the vegetable oil plays a part in ability of penetration. Almond and olive oil were shown to penetrate the outer skin layer slowly (mono-unsaturates) in abdominal guinea pig skin, while linseed, rich in polyunsaturates, penetrated rapidly. Because of this fact, the external emollient qualities of vegetable oils cannot be denied, therefore they are highly suitable as carriers for essential oils.

### What does penetrate the skin?

Because sensitisation reactions have been experienced, it seems some components of essential oils must pass into the skin. However, it is very difficult to find substantial scientific evidence that the absorption is of pharmacological significance (i.e., the amount absorbed causing systemic reactions such as diuretic). The whole oil does not appear to be absorbed into circulation through the skin at all. The main reference sources cited as evidence that skin absorption occurs have several areas of uncertainty that cannot be denied.

Certain constituents (i.e.,  $\alpha$ -pinene, camphene) are both absorbed in possibly significant amounts, as shown in tests with pine oil in a hot bath (combined with heat and humidity) and using a nose clip to avoid nasal inhalation. Both chemicals were found to be excreted in the urine for up to twenty-four hours later.<sup>(2)</sup> However, this experiment in a hot tub cannot be equated with an aromatherapy massage.

Benzoic acid (benzoin) is well known to be readily absorbed and has been used to test variability of absorption over the body. Inner forearms and back were found to be the best sites. Benzyl acetate (jasmine) has been recovered from urine 24 hours after neat application and both jasmine absolute and synthetic jasmine have been shown to produce irritation reactions. Benzyl benzoate (ylang ylang) and benzyl alcohol (up to 30% of Peru balsam) were absorbed within 24 hours. Cinnamic alcohol (cinnamon leaf & benzoin), cinnamic acid (cinnamon bark), both severe sensitising agents, and safrole (sassafras), a carcinogen, are also absorbed. Cinnamic aldehyde (cassia, cinnamon bark) was absorbed well following neat application and is not advised due to strong sensitising potential. Methyl salicylate (sweet birch, wintergreen) is also freely absorbed, especially in the presence of water. The ease of absorption of the above constituents may be why they are irritants or sensitisers. However only a few molecules are required to trigger a sensitisation reaction.

Many of the skin permeability tests used occluded (covered) isolated concentrated synthetic aroma chemicals as the prototype for essential oils,<sup>(3)</sup> which cannot compare to the whole essential oil. And no studies found on skin absorption used a mask to prevent absorption into the bloodstream from breathing the volatile components in through the lungs; with the exception of the pine oil bath test cited above (which inhibited nasal breathing and fails to state how the person breathed as there was no mention of oxygen apparatus in the methodology).

Some of the dermatological tests may be unreliable when compared to humans as they were unfortunately conducted on animals. Animal skin absorbs chemicals more readily than human skin.<sup>(3)</sup> Tests in vitro on isolated chemicals mentioned previously are unreliable when compared to the whole oil, and when compared to in vivo situation; however, care should be taken when using oils, which contain these chemicals in significant quantities.

In vitro studies on human (breast tissue, foreskin) and animal skin showed benzyl acetate was rapidly absorbed, creating a reservoir in upper dead cell layer. <sup>(4)</sup> This indicates that a major proportion of essential oils applied to skin may leave by evaporation, rather than passage through. Ethyl alcohol, a major part of perfumes, enhances percutaneous absorption and a recent study showed 75% of fragrance was absorbed through the skin when occluded (covered) regardless of the fragrance, as opposed to uncovered.

Testing with the whole oil (lavender) diluted (2%) and applied to human skin, still only showed a few individual chemicals (linalool and linalyl acetate) in the bloodstream. The test methodology did

not indicate any other amounts detected or if other constituents were even tested for. (5). Again, no breathing apparatus was used to prevent lung absorption, thereby, not satisfying the question of skin absorption of whole essential oils. Note: Since writing a similar test was done using a single chemical and breathing apparatus. The volume of chemical in the bloodstream was of no pharmacological significance when related to the volume an aromatherapist would use in a massage.

In addition, because the skin is an important site of metabolism of drugs and solvents, essential oils may be changed before the permeable constituents can enter. Essential oils may undergo molecular transformation by skin enzymes (P450's). Benzyl acetate (jasmine) is broken down very effectively by esterase enzymes in the skin.

Increasing the permeability of the skin is possible and can be achieved by several means. It must be remembered that increased permeability can also mean increased irritation and sensitisation with any essential oil. Hypersensitive or atopic persons (i.e., those suffering from hayfever, allergic rhinitis, eczema, asthma, wool or animal intolerance, or a family history of any of these) require greater caution. Caution is needed with irritating or sensitising oils when any of the following factors are present.

### **The following have been shown to increase permeability of the skin.**

Temperature -skin (hence caution during or after exercise, sauna)

therapy room

therapists hands

bath water

Humidity, presence of water - after soaking for a while the normally water-resistant skin becomes hydrated, thus more permeable.

Addition of detergent, soaps and solvents have been shown to increase permeability.

Damaged or abraded skin absorbs easier thus irritation and sensitisation reactions are possible (i.e., eczema, psoriasis, wounds).

Occlusion - covering the area aids penetration by preventing evaporation.

### **SUMMARY:**

It still remains to be shown that whole essential oils penetrate through the skin into the bloodstream, especially in any significant amounts, although single constituents may. Therefore, the statement that "whole essential oils pass into the bloodstream through the skin" is incorrect. They do enter the bloodstream very quickly through respiration, if the amount in the air is appreciable, therefore appearing in blood or urine. However, of the few constituents that may penetrate, besides being mostly irritant and sensitising, the amounts received in aromatherapy massage or needed to cause systemic pharmacological actions remains to be determined. It may be, therefore, that many of the actions claimed for essential oils may be due to inhalation, or to unreliable extrapolation of the internal ingestion (of oil or herbal extract) and may not apply to amounts absorbed through skin application. The question of VOLUME of oil or its constituent chemicals getting into the bloodstream via the skin is of critical importance because most people take in far more essential oils in food and drink.

Just because whole essential oils may not be absorbed via skin into the bloodstream creating a systemic reaction, does NOT mean beneficial skin affects and certainly the mental effects (relaxation) are very much possible with essential oil treatments. Skin treatments affect the

external layers where many problems are found. The antimicrobial and anti-inflammatory properties, as well as others, have proven essential oils remain quite efficient at treating many minor complaints. And the relaxing mental effects produced from the joy of using a pleasing fragrance will never be denied.

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