

## Pregnancy- A Couple of Articles On Pregnancy

### SAFETY IN PREGNANCY ESSENTIAL ISSUES II TONY BALACS

This report, the second in our essential issues series, provides sorely needed authoritative guidelines in an area of previous uncertainty and confusion. Pennyroyal is a mint and has the reputation of being able to induce abortion. The chief constituent of the steam-distilled essential oil is d-pulegone, which accounts for 60-90% of *Mentha pulgium* (European Pennyroyal) and of *Hedeoma pulegiodes*, North American Pennyroyal.

Because the oil has been available since the mid nineteenth century its toxic potential has long been recognized by research workers and by physicians who happen to have encountered its effects. But, in general, even herbalists and other alternative health practitioners seem to be unaware of pennyroyal's nature.

Pulegone, a monoterpene ketone, has the chemical name d-ppmenth-4(8) -en-3-one(2). It is chemically related to menthone and more distantly to menthol. Pulegone can cause serious liver disease if taken in more than minute quantities, making the essential oil of pennyroyal potentially very toxic indeed (3) As I shall discuss later, a toxic metabolite of pulegone is apparently produced by the cytochrome P450 hepatic enzyme system (the P450s).

This is believed to be the case because pre-treatment with phenobarbital, which increases P450 activity, makes pulegone more toxic, whereas inhibitors of P450 have the opposite effect. The guilty metabolite seems to be menthofuran.

### PRENATAL TOXICITY

But more of the biochemistry later. I would like to consider the whole issue of prenatal toxicity. Studying' the effects of drugs and other foreign Studying the effects of foreign . materials during pregnancy is highly problematic [3a] . Results of animal studies often correlate even more poorly with the human situation than in other fields of research. One offspring per pregnancy, the typical human result, is highly atypical of laboratory mammals, where there may be great variability in the toxic effects of administered substances within and between litters. Interpreting the results obtained in animal toxicity studies to the human is very difficult indeed, thalidomide being the most infamous example; the way in which this sedative produced its effects on fetuses is still not understood.

Prenatal toxicology includes the study of abnormal fertility, embryo toxicity and later fetotoxicity, perinatal and postnatal toxicity. These categories overlap, and substances may produce effects in only one or in several of them. Wherever toxic effects are looked for there are likely to be the following complications: a spontaneous background exists which makes it difficult to recognise weak effects; an observed effect may only occur under special conditions and in some species, and be irrelevant to humans; there is no

clearly defined border between gross structural abnormalities due to toxic substances (teratogens) and structural "variation".

There are very few data on pharmacokinetics, the distribution and fate of drugs within the human embryo, because it is almost impossible to design safe clinical experiments. It is often assumed that drug (or possibly essential oil) concentrations in the embryo reach similar levels to those in the mother's serum. This is likely to be wildly inaccurate for general application and the truth is that we simply do not know whether foreign substances circulating in the mother's bloodstream reach the developing child[4]. As a rule of thumb, molecules which can cross the bloodbrain barrier into the CNS are likely to reach the fetus; essential oils would be in this category.

### ABORTIFACIENT OILS

In 1913, a paper appeared in the *Journal of Pharmacology and Experimental Therapeutics* comparing pennyroyal, tansy, rue, savin and thyme on the isolated cat uterus [5]. None exhibited any stimulating effect but all were relaxant, with pennyroyal the most potent. By 1928, it was clear that abortifacient oils were only effective, and then spasmodically, at toxic doses; in essence, the mother aborted because she was poisoned by the oils. Experiments in rabbits showed that pennyroyal, tansy and savin were all toxic during pregnancy but were nonetheless unreliable abortifacients [6].

French research during World War II demonstrated that rue oil could strongly stimulate the mammalian uterus by an apparently direct action on smooth muscle and not as a result of non-specific toxicity[7]. This could be a basis for genuine abortifacient properties. Savin oil seems to be embryo toxic, in the sense that pregnant mice suffer weight loss. Also, those animals which resorb their litters generally show signs of liver damage [8]. There is no evidence that savin oil is fetotoxic; it does not seem to cause offspring to be malformed [9].

More recently, studies have attempted to show correlations between molecular structure and teratogenicity for fragrance additives [10]. Although it is much easier to show such links than it is to explain why they exist, there do appear to be differences between structurally related oils which distinguish innocent ones from potentially teratogenic ones. In particular, the "teratogenic structural features", such as unsaturation (the presence of one or more carbon-carbon double bonds) and carbonyl or aldehyde groups, may enhance the molecules' ability to interact with lipid constituents of the embryo's cell membranes.

Cinnamic aldehyde (CA), which comprises up to 90 percent of cinnamon bark and cassia oils, is found in non-alcoholic drinks, ice cream, chewing-gum and toothpaste. Its chemical structure features both an aldehyde group and a carbon-carbon double bond. CA is cytotoxic in vitro: it probably suppresses protein synthesis [11]. CA has been shown to be teratogenic in the chick but no clear effect on embryonic

development has been shown in mammal. It has been suggested, however, that rat embryos may be slightly more sensitive to the effects of CA than adults[11].

In essence, the mother aborted because she was poisoned by the oils "

Recent papers have presented good evidence that sabinyl acetate, 'present in *Plectanthus fruticosus* and savin essential oils is strongly teratogenic. The oils were given by subcutaneous injection to pregnant mice. Effects on fetal development included a large increase in the incidence of resorption, kidney and ventricular (heart) structural defects, skeletal alterations and, with a very high incidence, anophthalmia (lack of eyes) [12]. Savin has had widespread use as a folk abortifacient.

Other plants whose preparations have been popular for terminating pregnancies include cottonroot bark (Mexico), pulsatilla (India), rue, cohosh, sage and pennyroyal (USA)[13]. Of these, pennyroyal has become perhaps the most notorious, in the USA at least

#### PENNYROYAL CASE STUDIES

Pennyroyal is marketed in the US as an insect repellent. In Britain, the oil is less widely available, but the herb is commonly found on the shelves in medical herbalists' shops. Pennyroyal has been used in one form or another to induce abortion for at least 2,000 years; there is no documented evidence that it can do this at other than near-lethal doses for the mother[14].

In 1897, the *Lancet* reported the case of a 23 year-old woman who had taken a tablespoonful of pennyroyal oil in an attempt to bring on menstruation, which had been in abeyance for six-months [15]. She suffered acute gastritis, but recovered fully.

In 1906, the case of a woman who took about half-an-ounce of "pennyroyal essence", possibly containing a tenth pennyroyal oil by volume, was reported in the *British Medical Journal*. The woman was a week past her expected menstrual period. She became extremely toxic, the effects of the oil starting only ten minutes after ingestion. Within two hours she was unconscious but had recovered the next day. Her symptoms had included tingling and numbness of the extremities[16].

The same journal reported a similar case seven years later; the woman concerned was febrile, delirious, vomiting and suffering from involuntary twitching. Again the effects had commenced within half-an-hour of taking pennyroyal oil. She had recovered by the next day[17].

A much more serious case was reported in the *Lancet* in 1955. It was not possible to determine how much oil was taken, but the effects were abortion, vaginal bleeding, haemolytic anaemia (destruction of the red blood cells) and acute destruction of the kidney tubules, with death following massive urea leakage into the blood[18].

Three cases of pennyroyal poisoning which have become quite well known were reported in Colorado " The cause was brain stem dysfunction due to liver damage " in 1978. The first woman had taken a quarter-ounce of oil to induce abortion. She presented with nausea, numbness and tingling of the extremities and dizziness. Her pregnancy did not abort (it was within the first month) and she had recovered the same day. She later had a legal abortion.

The second woman had ingested a similar quantity and had similar symptoms to the first, with the addition of a burning sensation in the throat. Liver and renal tests were normal and she was discharged the next day. Her one-month-old pregnancy did not abort.

The third case was of an 18-yearold woman frightened of being pregnant but actually not, depressed and, on her own estimation at least, having a tendency to irregular menses. She had taken one ounce of pennyroyal oil and presented with rash, abdominal pain and frequent vomiting of blood. These effects persisted over the following 12 hours and she began to bleed from the vagina as well as from injection sites. Twenty-four hours after ingestion, liver function tests had become abnormal, she lapsed into coma, developed fluid on the lungs and died on the sixth day in hospital. The cause was brain stem dysfunction due to liver damage. Note that the dose of pennyroyal oil in this case was four times that in the previous two[19,20,21].

A case involving pennyroyal herb infusion combined with ingestion of the oil was reported in 1979 in the Journal of the American Osteopathic Association. The patient, a mother of two, took the preparations to induce menstruation. The leaves, taken in gelatin capsules were partly effective, in that they induced some "sporting" of underwear, but the woman nevertheless decided to take 15 ml of pennyroyal oil. She suffered CNS depression, vomiting and fluid on the lungs. Treatment by gastric lavage, activated charcoal, milk of magnesia and acetylcysteine, a liver protector, resulted in rapid improvement. She was discharged after 96 hours[22].

#### TOXICITY RESEARCH

In rats, pennyroyal oil has been found to produce acute liver and lung damage, the active constituents being identified as pulegone, isopulegone and menthofuran. A particular group in the pulegone molecule has been implicated[23,23a]. Pulegone has also been found to destroy the enzyme cytochrome P-450 in rat liver microsomes[24] and to produce generalised toxic effects in liver[24a]. Interestingly, prior inhibition of hepatic P-450 seems to decrease pulegone's hepatotoxicity markedly, suggesting that P-450 stimulates its own destruction by metabolising pulegone to a more toxic compound [26]. This metabolite appears to be menthofuran[27], although others are undoubtedly involved[28]. In particular, there seems to be a highly reactive intermediate which irreversibly binds to hepatic microsomes in vitro[29].

## THUJONE RICH OILS

Tansy (*Tanacetum vulgare*) contains 66- 81 percent thujone. In large doses, tansy oil is extremely irritant to mucous membranes and has also caused seizures[31]. Other toxic effects have included cramps, irregular heartbeat, hepatitis and uterine bleeding. Tansy's thujone content has given it a use as a vermifuge, emmenagogue and abortifacient[31a]. Most fatalities have resulted from ingesting tansy oil, which is certainly to be avoided in pregnancy, although fatal poisonings with infusions and powders have also occurred[32].

Wormwood (*Artemisia absinthium*) is often referred to as "absinthe". The leaves and flowering tops contain up to 1. 7 percent essential oil, of which between 34 and 71 percent will be thujone. The toxic effects of wormwood are therefore similar to those of tansy [34], although absinthe is reputed to have beneficial bitter tonic properties and has traditionally been used as a remedy for epilepsy [33].

Mugwort (*Artemisia vulgaris*) is closely related to wormwood but contains less thujone (24-46 percent in 0.3 percent plant oil). Like wormwood, it has been used as a remedy for epilepsy [33] and has a reputation for abortifacient activity [35].

Sage (*Salvia officinalis*) contains between 1.0 and 2.8 percent essential oil, of which about half will be thujone (36-62 percent). The Essential Oil Safety Data Manual comments that unless sage oil contains an as yet unidentified substance which somehow reduces the toxicity of its thujone, which is not impossible but is not particularly likely either, sage must be assumed to be as toxic as tansy, wormwood and mugwort.

Sage, tansy, mugwort, wormwood and thuja, the prototype for thujonecontaining essential oils, should all be absolutely avoided during pregnancy and, with the possible exception of sage, should really be avoided altogether.

Rue is rather different to the thuja-containing oils. The herb contains up to 0.1 percent essential oil, of which 90 percent maybe methyl nonyl ketone, a very unusual ketone not found elsewhere [33]. Although the individual ingredients have appeared safe in toxicity tests [36], the whole oil definitely produces toxic effects [31,37], and has been recommended never to be used in flavour or perfume work. Although methyl nonyl ketone is undoubtedly irritant, methyl umbelliferone, a minor constituent, may be the most toxic component of the essential oil, which causes epigastric pain, convulsion, vomiting, haemorrhage and abortion [38].

I often seem to end my articles by suggesting that more research is needed, and this one is no exception. In the meantime, the best advice can only be to exercise great caution when giving oils to pregnant women, and to avoid pennyroyal oil at all costs.

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THE INTERNATIONAL JOURNAL. OF AROMATHERAPY  
spring 1992

During my work as a nurse I had used massage extensively, but when I began to train in midwifery it soon became apparent that this was going to be a very useful skill.

Aromatherapy in pregnancy and labour is by no means a new idea; it was regularly used in ancient cultures because the sense of smell is so heightened at this time. Traditionally women and midwives crushed aromatic herbs in their hands for inhalation or smoked marigold flowers to help with labour and placental expulsion.

In today's world we tend to detach motherhood from 'normal' life, so women may not have any contact with pregnancy and labour until they become pregnant themselves and this 'unknowing' breeds fear. Modern women also often lead stressful and demanding lives and it is not unusual for them to start a pregnancy in poor physical and mental condition.

As drug therapy becomes less fashionable and women have a much greater say in the way they are treated in the birthing experience, I see more women looking into the alternative forms of treatment. Encouragement from midwives helps to inspire this.

My ante-natal classes are full of women and their partners worrying about pain relief and caesarean sections. I have found people are very eager to learn alternatives to routine drugs such as pethidine and entonox,

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## ESSENTIAL OBSTETRICS

JULIETTE GUENIER RGN, RM

A working midwife,<sup>1</sup> who holds diplomas in nutritional medicine, aromatherapy and lymphatic drainage, gives practical suggestions on essential oils for ante and post natal care and to soothe during labour: and I also teach how to create the mood for labour using soft lights, favourite foods, essential oils and music.

### RELAX AND REST

We are always encouraging women to relax and rest during pregnancy, but we don't tell them how to do this. A warm lavender bath is far better than sitting in front of the telly with a box of chocolates. Aromatherapy is not only useful for calming the woman and her midwife, but also gives a birthing partner a much needed role, helping to relax the nervous father who hovers around the delivery room not knowing what to do.

I usually introduce women to aromatherapy using lavender, and suggest they use it in the bath, for massage or for burning. I found if I used a wide range of oils couples lost interest, it became too messy, expensive or time-consuming.

When I am teaching massage I do a lot of work with the mother getting to know the growing baby through abdominal massage. This is also a rewarding thing for the couple to do together, and the calming effects of the oils relaxes the mother and soothes the baby.

I show couples how to mix massage oils at about 36 weeks gestation using a base oil and wheatgerm as a preservative. They

can be stored at room temperature in

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coloured glass bottles so they are ready to be easily grabbed when the time comes for hospital admission.

I usually recommend that couples investigate how the hospital feels about use of burners in a labour room. As the rooms often contain oxygen, the burner could be a fire risk if it got knocked over in an emergency.

Some essential oils are thought to be detrimental in pregnancy, and I usually recommend that women avoid those listed here, especially in the first three months.

#### . BEAN BAG

When massaging oils into a pregnant women it is very important to ensure she is comfortable and relaxed. Finding positions in later pregnancy is often difficult.

To perform back massage I get her to sit forward over a straight back chair leaning on a cushion. For head, neck or foot massage I advise that we use a bean bag or cushions with the legs and arms supported. These positions can also be used in labour with lower back massage performed leaning on a bed whilst standing, squatting or supported by the wall.

Last year I visited a birthing community in America where the midwives had done a lot of work in preparing the perineum (between the rectum and the vagina) so as to prevent tearing.

The stimulating action of massage helps to cleanse the body

A study was carried out in 1987 by Melissa Avery and Laura van Arsdale which looked at 29 first time mums who performed six weeks of daily massage against a control group of 26 women who did not. Episiotomy and second degree tear occurred in 48% of those massaging compared with 77% in the control group.

Many second time mothers in my antenatal class back this study and have used lavender and geranium with good results. The massage needs to be practised daily for five to ten minutes six weeks prior to delivery.

The procedure is best carried out following a warm bath to increase circulation and soften the tissues, and with an empty bladder. The woman should use a mirror so she can see she is applying the oils to the perineum and the posterior vaginal wall, special attention being given to any scar tissue from previous deliveries.

The oil is made up using a base oil, wheatgerm, lavender and geranium. Two index fingers are inserted two inches into the vagina pressing down towards the rectum. The massage movement is in a "u". The tissues relax and stretch very quickly. The vagina should be stretched open for 20 seconds to feel the tingling or burning process associated with the head crowning.

## DETOXIFICATION

The hormone progesterone helps the body soften and accommodate the growing baby and also softens blood vessels

which are carrying twice as much blood as normal, putting stress on large organs of the body and lower limbs. Demand on the lymphatic system increases and detoxification is more difficult, so the stimulating action of massage helps to cleanse the body.

Some pregnancies are not straightforward and women can end up in hospital for a number of weeks or even months for rest and observation. This is usually distressing, and the use of a burner in the ward and massage with essential oil when possible is beneficial. Taking time to massage someone's feet helps them relax and gives time to discuss worries about the pregnancy, labour ahead or family issues.

Pregnancy-induced hypertension or raised blood pressure is common in first time mothers. Oils which have been very useful in these cases are lavender, neroli, jasmine and rose, working with leg and head massage.

Sometimes midwives have to cope with miscarriage or stillbirth, an experience where the couple still have to go through labour but are alone at the end.

Once on night duty I was left alone with a very distressed lady who was miscarrying twins. She said she found the smell of lavender very soothing so I gave her a massage, and the atmosphere in the room changed, she was relaxed and calm and coping. Such situations are also traumatic for the midwife and I have found using essential oils gives me more confidence.

## BACK MASSAGE

Once labour is in progress and contractions are regular, lots of back massage, bathing and contact are needed. If the woman

relaxes she will increase her natural pain relief in the form of endorphins, increase her energy and reduce the stress to the baby by ensuring it gets enough oxygen during delivery.

Very active babies can be calmed by using oils. When massaging a woman while she is attached to the monitor recording the baby's heart- beat I have watched how an active baby calms to a sleeping trace and maintains a constant reactive heart trace.

Clary sage helps with stimulation of contractions and its euphoric properties help stabilise the mood.

As labour progresses women indicate where they want to be massaged, starting at the lower back and working towards the buttocks, legs and ankles to release tension and encourage movement which helps to dilate the cervix.

I often find women lose 'control' when coming into the second stage of labour, the time known as transition. If they have maintained the use of oils and relied on massage and breathing they may find suddenly they don't want to be touched and the oils become overpowering and offensive.

I tend to tail the oils off when approaching full dilation of the cervix and just work at keeping the woman calm and in control.

Not all labours go smoothly, women often find contraction pains too overwhelming and they cannot tolerate them. Then the mother or baby may become distressed and a mechanical delivery is necessary. I have performed head and neck massage with gentle uplifting oils such as rose when someone is undergoing a

forceps delivery or a caesarean section under epidural where the woman stays awake.

I have never used oils around the time of the placenta being delivered as I normally get the woman to stimulate

the breast by feeding the baby, thus producing oxytocin.

Recently I have been working on a post natal ward. I always try to use lavender and juniper in baths following delivery for their calming, cleansing and analgesic properties.

## ALTERNATIVE METHODS

Although women rarely stay long in hospital there is still time to teach alternative methods of pain relief and how to improve the healing of the perineal area. Lavender is my favourite oil, although I have used marjoram and juniper for pain relief. After-pains as the uterus contracts back into the pelvis also respond well to these.

Quite a few women find that their ankles become swollen following delivery. I have had good results from bathing and gentle massage using geranium.

Breast massage is very soothing in the first few days as the milk begins to come in. Lemongrass and aniseed are useful as stimulants, but if the mother wants to bottle feed, peppermint and sage are useful to suppress lactation when used in a luke warm bath or on compresses worn in the bra.

Each pregnancy and labour is unique, and I like the idea that with essential oils couples can take control. The oils are non-

invasive but women feel their involvement in their labour gives them the choices they need.

10% comes from countries including France, Italy, Bulgaria, Morocco, Australia and New Zealand. The essential oil yield varies from 0.1 % to 1.0%, usually around 0.4%. Composition is affected by the usual environmental factors such as nutrient regimen, rainfall, hours of sunshine, temperature fluctuation, harvesting time and extraction methods. In the USA some 2,400 tonnes of peppermint oil per annum are currently produced, and cultivation and disease/weed control are well established. The use of chemical fertilisers and pesticides would appear to be widespread (2,6,9).

There are five principal US production areas, with clear composition differences between each. The menthol content can vary between 29% and 46% with high variations for all the other major components. Similar variations in composition apply to peppermint oils from other geographical sources. A "typical" American peppermint composition is shown in table 1. According to Haarman and Reimer peppermint oil contains around 1,000 components. The great majority of these have yet to be identified (3,5).

Neither peppermint nor eucalyptus is highly toxic and both are extensively used as flavour ingredients. However, both pulegone and menthofuran are toxic (see page 24) and for the purposes of aromatherapy low concentrations of these components are desirable. Pulegone content, although normally 1-2%, can reach 11 % and menthofuran, generally 1-3%, can reach 10%. Menthone, usually around 20% would also be best at low levels, while a high menthol content is desirable, because of its therapeutic properties. Peppermint is best harvested when not in

flower, since the flower oil contains 20-40% of menthofuran, and 10-15% of pule gone (5).

## APPLICATIONS

As flavour ingredients mint oils rank third in the world after vanilla and citrus. Unlike many other taste trends, mints appeal to all consumer groups, irrespective of age, sex or ethnic background. The menthol-induce~

cooling/refreshing effect has gained great favour in all kinds of products which find their way into our mouths. The mint/menthol taste and odour have an almost unrivalled association with freshness, cleanliness and hygiene (3).

Mint oils are rarely used in perfumes, with the exceptions of some cooling colognes and footsprays, and occasional hair products and shave foams. Menthol and peppermint are also used as flavours in cigarettes.

The US mouthwash industry is currently worth \$200 million per annum. Listerine, the brand leader, contains thymol, cineole, methyl salicylate and menthol as its active ingredients.

Peppermint is unique in that it is the only essential oil to be licensed as a medicine. The license covers its use in the treatment of irritable bowel syndrome. Two products are on the market, "Mintec" (Smith, Kline and Beecham) and "Colpermin" (Tillotts), They both contain peppermint oil in enterically coated capsules designed not to dissolve until they reach the large intestine.

Very few people in 'the UK seem to be aware of the existence of these products, even though they are both available over the counter in pharmacies.

The fact that peppermint oil is licensed as a medicine has not restricted its continued use in consumer products. nor its availability over the counter as a pure essential oil. Fears that, if essential oils should' become licensed as medicines their availability would be restricted, may therefore be unfounded.

As with all essential oils used in aromatherapy it would be nice to see the development of mints organically cultivated to produce completely nontoxic but pharmacologically highly active essential oils.

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