Tea tree oil skin reactions – misleading claim by doctors on the internet

In a report published on the Internet in 2007, two doctors at Thomas Jefferson University, Philadelphia, report a case of tea tree allergy in a woman to 5% tea tree oil. There is no reason to doubt that this is a genuine report (Stonehouse & Studdiford 2007). However, they also make the claim that "*allergic contact dermatitis has been reported in about 5% of those who use tea tree oil*." Two of the three references they give in support of this statement cite individual cases not prevalence of reactions, and the third is a book, not a research paper, so the reason for settling on 5% is not explained.

An analysis of the published data on tea tree allergy does not substantiate their view. In four studies, tea tree oil was patch tested at 5% or 10% in a total of 6,637 dermatitis patients, with positive reactions in 79 of them, or 1.2% (Lisi et al 2000, Pirker et al 2003, Rutherford et al 2007, Veien et al 2004). (In fact the case cited by Stonehouse & Studdiford used tea tree oil to treat chronic tinea versicolor.)

However, the 1.2% does not represent tea tree allergy prevalence, since dermatitis patients are not representative of the general population - "*those who use tea tree oil.*" A person with a skin condition reacts more readily to a potential allergen than a person with healthy skin (Basketter et al 2002, Boukhman and Maibach 2001). In Europe, the average percentage of dermatitis patients that are allergic to the Fragrance Mix (FM, a mixture of seven aromachemicals plus oakmoss absolute) is 10.5% (Schnuch et al 1997), while the highest equivalent percentage of the general population in Europe who react to the FM is 1.8% (Dotterud and Smith-Sivertsen 2007, Mortz et al 2002, Nielsen and Menné 1992, Schnuch et al 2002, Seidenari et al 1990). Therefore, to extrapolate from dermatitis patient data to the general population, it might be reasonable to divide by a factor of 5.5. In this scenario, 1.2% of dermatitis patients would be theoretically equivalent to 0.22% of the general population being allergic to tea tree oil.

Even this figure is not representative of actual risk, since patch testing exaggerates real-world use of a substance because of the protocol used - covering the skin with an impermeable patch for 48 hours (Gerberick et al 2001, Robinson et al 2000). A patch test with 5% tea tree oil, therefore, is not equivalent to a lotion, oil or other product containing 5% tea tree oil, where much of the oil is washed off, allowed to evaporate, or rubs off on clothing.

Using patch test data to predict real-world risk is highly problematic, so these numbers are at best approximations. Nevertheless, the low risk of diluted tea tree oil is supported by the results of clinical trials in which it was applied to the skin. If 5% of people reacted to tea tree oil, then a test involving 295 people should give about 15 positive reactions.

However, in six clinical trials using tea tree oil at either 5% or 10%, there were no allergic reactions among 295 patients, even though 67 of them had an inflammatory skin condition. Mild reactions were not significantly greater than in placebo groups, and in some cases were actually less (Caelli et al 2000, Dryden et al 2004, Enshaieh et al 2007,

Satchell et al 2002, Syed et al 1999, Tong et al 1992). The lack of even a single reaction suggests a tea tree allergy prevalence somewhere below 0.34%, giving credence to the idea that real-world risk could be less than 0.22%. Even 0.1% is not insignificant in a population of millions, but it's a great deal less than 5%.

All of which highlights that even information hosted by medical institutions or universities may be unreliable and misleading.

References

Basketter DA, Evans P, Gerbick F et al 2002 Factors affecting thresholds in allergic contact dermatitis: safety and regulatory considerations. Contact Dermatitis 47:1-6

Boukhman MP, Maibach H I 2001 Thresholds in contact sensitisation: immunologic mechanisms and experimental evidence in humans – an overview. Food & Chemical Toxicology 39:1125-1134

Caelli M, Porteous J, Carson CF et al 2000 Tea tree oil as an alternative topical decolonization agent for methicillin-resistant *Staphylococcus aureus*. Journal of Hospital Infection 46:236-237

Dotterud LK, Smith-Sivertsen T 2007 Allergic contact sensitization in the general adult population: a population-based study from Northen Norway. Contact Dermatitis 56:10-15

Dryden MS, Dailly S, Crouch M 2004 A randomized, controlled trial of tea tree topical preparations versus a standard topical regimen for the clearance of MRSA colonization. Journal of Hospital Infection 56:283-286

Enshaieh S, Jooya A, Siadat AH et al 2007 The efficacy of 5% topical tea tree oil gel in mild to moderate acne vulgaris: a randomized, double-blind placebo-controlled study. Indian Journal of Dermatology, Venereology & Leprology 73:22-25

Gerberick GF, Robinson MK, Felter SP et al 2001 Understanding fragrance allergy using an exposure-based risk assessment approach. Contact Dermatitis 45:333-340

Lisi P, Meligeni L, Pigatto P et al 2000 Prevalenza della sensibilizzazione all'olio essenziale di *Melaleuca*. [The prevalence of sensitivity to *Melaleuca* essential oil.] Italian Annals of Clinical & Experimental Allergological Dermatology 54:141-144

Mortz CG, Lauritsen JM, Bindslev-Jensen C et al 2002 Contact allergy and allergic contact dermatitis in adolescents: prevalence measures and associations. The Odense Adolescence Cohort Study on Atopic Diseases and Dermatitis (TOACS). Acta Dermato-Venereologica 82:352-358

Nielsen NH, Menné T 1992 Allergic contact sensitization in an unselected Danish population: The Glostrup Allergy Study, Denmark. Acta Dermato-Venereologica 72:456-460

Pirker C, Hausen BM, Uter W et al 2003 Sensibilisierung auf Teebaumöl in Deutschland und Österreich - Eine multizentrische Studie der Deutschen Kontaktallergiegruppe. [Sensitization to tea tree oil in Germany and Austria. A multicenter study of the German Contact Dermatitis Group]. Journal der Deutschen Dermatologischen Gesellschaft 1:629-634

Robinson MK, Gerberick GF, Ryan CA et al 2000 The importance of exposure estimation in the assessment of skin sensitization risk. Contact Dermatitis 42:251-259

Rutherford T, Nixon R, Tam M et al 2007 Allergy to tea tree oil: retrospective review of 41 cases with positive patch tests over 4.5 years. Australasian Journal of Dermatology 48:83-87

Satchell AC, Saurajen A, Bell C et al 2002 Treatment of interdigital tinea pedis with 25% and 50% tea tree oil solution: a randomized, placebo-controlled, blinded study. Australasian Journal of Dermatology 43:175-178

Schnuch A, Geier J, Uter W et al 1997 National rates and regional differences in sensitization to allergens of the standard series. Population-adjusted frequencies of sensitization (PAFS) in 40,000 patients from a multicenter study (IVDK). Contact Dermatitis 37:200-209

Schnuch A, Uter W, Geier J et al 2002 Epidemiology of contact allergy: an estimation of morbidity employing the clinical epidemiology and drug-utilization research (CE-DUR) approach. Contact Dermatitis 47:32-39

Seidenari S, Manzini BM, Danese P et al 1990 Patch and prick test study of 593 healthy subjects. Contact Dermatitis 23:162-167

Stonehouse A, Studdiford J 2007 http://www.consultantlive.com/showArticle.jhtml?articleID=201000174

Syed TA, Qureshi ZA, Ali SM et al 1999 Treatment of toenail onychomycosis with 2% butenafine and 5% *Melaleuca alternifolia* (tea tree) oil in cream. Tropical Medicine & International Health 4:284-287

Tong MM, Altman PM, Barnetson RS 1992 Tea tree oil in the treatment of tinea pedis. Australasian Journal of Dermatology 33:145-149

Veien NK, Rosner K, Skovgaard GL 2004 Is tea tree oil an important contact allergen? Contact Dermatitis 50:378-379