



Usage patterns of aromatherapy among the French general population: A descriptive study focusing on dermal exposure



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ABSTRACT

Although likely benefits of aromatherapy are well documented, little is known about essential oils consumption and exposure to molecules present in the oils. The aim of our study was to determine usage patterns of 12 types of essential oils among a quite large panel, sorted per sex and quintile of age from birth to 70. A survey was conducted in September 2014 among 1507 French individuals, selected to build a representative panel of the general population. The key point of our study, apart from the fact that it has never been done among general population, was the focus on dermal exposure. Information about types of essential oils used, skin areas exposed, frequencies and quantities were collected. Our work revealed that some sub-populations could be significantly exposed to molecules of toxicological concern, especially in terms of skin sensitization. This work is the first step to assess human exposure to these molecules, and will help safety authorities and risk managers to protect the population.

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1. Introduction

According to the French National Agency of Medicine and Health Products Safety (ANSM – Agence Nationale de Sécurité du Médicament et des produits de santé) and the European pharmacopeia, an essential oil (EO) is defined as an “odorous product, usually of complex composition, obtained from a botanically defined plant raw material by steam distillation, dry distillation, or a suitable mechanical process without heating” (ANSM, 2008a; European Pharmacopeia, 2008). The use of these oils for medicinal purposes is defined as aromatherapy. Numerous publications demonstrate the likely benefits of aromatherapy on humans, including effects on stress reduction or depression (Tang and Tse, 2014), surgery pain (Marzouk et al., 2014) or even effects on sleep (Hwang and Shin, 2015).

Besides, EOs are also found in many consumer products such as cosmetics, detergents, biocidal products, drugs (ANSM, 2008a; SCCS, 2012) or botanical preparations intended for use as food supplements (EFSA, 2009). In these cases, products must comply

with specific regulations to ensure human health safety. In the case of cosmetics and personal care products for example, industry has to apply for authorization by a regulatory procedure following the European regulation (EC) No 1223/2009 on cosmetics (EU, 2009). This latter is based on the opinions of the Scientific Committee on Consumer Safety (SCCS), providing expertise on health and safety risks.

EOs are composed of naturally occurring molecules which can be toxic, carcinogenic (Bakkali et al., 2008) or allergenic (ANSM, 2008b; SCCS, 2012). Some terpene compounds, e.g. cineole, camphor and menthol, present in numerous types of EOs can cause severe neurological disorders, e.g. seizures, in susceptible individuals such as infants (ANSM, 2008b). Methyleugenol, found for example in Tea tree oil (Bakkali et al., 2008) exerts genotoxicity and carcinogenicity on rats (SCCNFP, 2000). Evaporation of EOs in an aromatherapy environment causes formation of formaldehyde (Huang et al., 2012), classified as carcinogenic to humans (Group 1) by the International Agency for Research on Cancer (IARC, 2012). EOs also contain allergenic compounds such as limonene, citral or oxidized linalool (ANSM, 2008b; SCCS, 2012). About these allergenic substances, the SCCS, in its opinion on fragrance allergens in cosmetic products, identifies fragrance ingredients which are established contact allergens in humans, based on results from

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human clinical and epidemiological data. For some allergens, the SCCS derived a concentration limit expected to protect most patients from allergies to these ingredients, or from reacting to the cosmetics which contain them (SCCS, 2012). These recommendations, however, are only applicable to cosmetic products and do not apply to EOs used solely. Indeed, to date, in the European community, there is no scientific committee specifically dedicated to EOs especially when they are used as raw products. Thus, specific regulation for aromatherapy products for their current usage by human does not exist, although the SCCS might be responsible for the evaluation of the safety for the usage of EOs as a component of cosmetic products, or the European Food Safety Authority (EFSA) for their usage as dietary supplements. As a consequence and although EOs may contain these types of allergenic substances, regulatory measurements to limit allergens in these products cannot be established.

For cosmetics products, large-scaled consumption surveys have been done recently in different regions such as California, the Netherlands or France (Wu et al., 2010; Biesterbos et al., 2013; Ficheux et al., 2015; Comiskey et al., 2015), providing important information for safety assessment, especially as a basis for determining the exposure to contact allergens from cosmetics. To date, such large surveys have not been conducted for aromatherapy, although a few studies have been conducted in restricted sub-population such as Japanese university students (Ujii and Okada, 2014) or Australian pregnant women (Sibbritt et al., 2014). As a consequence, data on the types of EOs used in the general population, as well as the quantity and frequency of use are lacking. It appears therefore that the safety of the consumers is difficult to ascertain regarding EOs consumption. In this context and considering the SCCS opinion on fragrance allergens (SCCS, 2012), we chose to study EOs consumption, and focus on dermal exposure, with the aim to better describe aromatherapy use patterns for twelve types of essential oils in a French general population.

2. Materials and methods

2.1. Data collection

Questionnaire Design: a web survey was conducted in September 2014 by a French national survey company, structured to determine the conditions of EOs use by the French population, especially per dermal route. The questions and multiple responses we chose to include in the survey were determined preliminarily to our study, by closely observing tips and advice given on aromatherapy websites or at the different sales outlets.

The questionnaire was structured on three main axes, and built as follows:

First section – General data (8 questions): sex, age, pregnancy status for females, profession, information about place of residence (region, size of the living town, city or countryside, and information about children (age and sex) was collected.

Second section – Essential oils consumption (4 questions with or without multiple choices):

- Do you use EOs?,
- For which type of use? Three choices were given to the respondent i.e. inhalation (directly or through a diffuser), oral route or dermal application,
- Who advised you to use EOs at first*? (multiple choices were given i.e. Family/friends, Pharmacist, At the point of sale, Media, Alternative Medicine therapist, Physician, Naturopathic Doctor)
- Where do you buy your oils*? (multiple choices were given i.e. Drugstore, Specialized stores, Web stores, Supermarkets, Herbalist)

Third section – Focus on dermal exposure route (4 questions with multiple choices): when a panelist responded using EOs per dermal application in the second section, additional information was collected.

- Body zone of application*: Multiple choices were given i.e. forehead, philtrum, neck, temples, face, wrist, arms, foot, calf, legs, chest/breast, back, stomach, and full body.
- Type of EOs*: twelve choices were given i.e. *Lavanda, Tea tree, Eucalyptus, Helichrysum, Niaouli, Pinus, Citrus, Mentha, Ravintsara, Rosmarinus, Vanilla* and *Ylang*.
- Frequencies: For each oil selected by the respondent, four choices were given i.e. at least once a day, at least once a week, at least once a month, less often.

Quantities: as for frequencies the respondent was asked to give the number of drops per application and per type of EO in the most accurate way.

* Given our list of multiple answers was not exhaustive, we chose to add the answer “other (s)” to these multiple choices, inviting the respondent to give us any useful information by writing complementary data, e.g. another type of EO absent from our list.

2.2. Surveilled population

1507 individuals aged 0 to 70 were invited to respond the survey, selected to build a French representative panel, using quotas by sex and age (0–14, 15–24, 25–39, 40–59, 60–70 and 15–50 years pregnant women), socio-professional category, geographical data (northwest, northeast, southwest, southeast, Ile-de-France) and degree of urbanization of the residential city (<2000 people, 2000 to 20,000 people, 20,000 to 100,000 people, Paris metropolitan area). Parents of children under 14 years of age were asked to complete the questionnaire for their children.

2.3. Data and statistical analysis

General consumption data: descriptive characteristics were first carried out by age and sex. We performed a series of univariate logistic regressions with a different variable of interest, in order to determine factors influencing aromatherapy products consumption among the socio-demographic variables. Firstly, we compared males versus females, then subpopulations per quintile of age, pregnant females versus non-pregnant females, sub-populations per socio-professional category and, lastly, subpopulations per living place.

Focus on dermal exposure: percentages of users exposed per dermal route were sorted by sex and age (as for general consumption data). Chi-square tests were performed to compare prevalence of users per age and per sex.

Data on type of EOs and zones exposed were also analyzed by comparison per age and then sex. Chi-square tests were performed to compare the percentage of adult males and females users firstly per age, i.e. over 15 years old. Prevalence per age were pooled when no statistical difference were observed. The same test was then used to compare prevalence between males and females. Data on skin areas were classified into 8 generic groups, due to the high variability of the responses given by the panel, i.e. forehead, philtrum, neck and temples were gathered in the “face and neck group”, wrist and arms in “upper limbs group”, foot, calf and legs in “lower limbs group”, specific uses such as application on spots or bruises in “other” group. Concerning the four other groups, i.e. chest/breast, back, stomach and full body, responses were taken directly.

For frequency of use, responses were replaced by frequencies

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