Essential Oils Gain Credibility in the War on Pathogens

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Abstract

As far back as 1887 research shows the effectiveness of essential oils on the major illnesses of mankind. This paper highlights the evolution of the important research and the development of the technology and methods that are necessary today to prove that essential oils are effective in the war on pathogens that can cause colds, influenzas, TB and even SARS.

Discussion

History and modern research are finally in agreement. Generations of Aromatherapists, Grandmas, and knowledgeable caregivers have known that the inhalation of essential oils, usually in a salve or by steam inhalation, was one of the best treatments for respiratory infections.

The antibacterial properties of perfume oils were first demonstrated in 1924 by Dyche-Teague on a mixed bacterial culture obtained from the respiratory tract of a man. J.J. Bryant, who used for his test, a pure culture of B. coli communis, confirmed the work in that same year. Follow up research did not appear until 1958 when Maruzzella, J.C., et al. tested perfume oils against selected bacteria and fungi using the direct contact method. The results from that study showed that 90% or more of the oils were effective in killing at least one of the fungi tested. This team of researchers decided in 1959 to again test the same perfume oils in the vapor stage against 6 fungi. The common fungi to both tests were Candida albicans and Aspergillus niger. The research by Maruzzella, J.C., et al. [1] indicated that the "Data presented show that 82 of the 100 perfume oil vapors studied possess antifungal activity against at least 1 of the 6 tested organisms". The organisms that these vapors were tested against were: Saccharomyces cereviseae, Aspergillus niger, Gibberella fugikuroi, Candida albicans, Rhodotorula mucilaginois, and Geotrichum candium. The choices of fungi may not be the ones that we would choose today, except perhaps Candida albicans and Aspergillus niger, but this study clearly shows that even with perfume essential oil vapors, there is a substantial antifungal activity and this should have sparked many researchers curiosity about this topic. This was the second study conducted by Maruzella. Maruzzella followed these studies with a third study in 1960[2] in which he tested the vapors of 133 essential oils in vitro for antibacterial activity against six test organisms including Escherichia coliu, Staphyloccus aureus, Bacillus subtilis var. aterrumus, Streptoccus fecalis, Salmonella typhosa, and Mucobacterium avium. According to Maruzzella this study was undertaken in an attempt to evaluate a large number of essential oil vapors against a variety of Gram-positive and Gram-negative bacteria. 105 oil vapors showed antibacterial activity, with Gram-positive bacterial being more vulnerable to essential oils than Gram-negative bacteria.

Maruzzella reported "Studies on the action of essential oil vapors on anthrax spores were reported in 1887 by Chamberlain (1) [1887]. Subsequent investigations by Greig-Smith (2) [1919], Macht and Kunkel (3) [1920], Morel and Rochaix (4, 5) [1921] & [1925], Schobl and Kusama (6) [1924], Coulthard (7) [1931], Remlinger and Bailly (8) [1942], and recently by Ryu (9) [1956] and Grunn (10) [1959] have clearly demonstrated that essential oil vapors possess antibacterial properties. Yet the proper evaluation of these volatile plant products on bacteria cannot be fully realized because of the diverse methods used by various investigators and the relatively small number of essential oil vapors tested."

Research in this field continued, but the results were not convincing. A.M. Janssen, et al.[3] in the review for "Planta Medica, Journal of Medicinal Plant Research" entitled "Antimicrobial Activity of Essential Oils: A 1976 - 1986 Literature Review. Aspects of the Test Methods" concluded "Testing and evaluation of the antimicrobial activity of essential oils is difficult because of their volatility, their water (in)-solubility, and their complexity. Four factors are especially important when testing essential oils: the assay technique; the growth medium; the micro-organism; the essential oil." Janssen's conclusion was that "results given in the literature with regard to the testing of essential oils for antimicrobial activity were difficult to compare. The test methods used differ widely and important factors influencing the results were frequently neglected. Thus, the conclusions drawn in many papers are not based on reproducible experiments. In future studies, one should, for example, mention the strain number of the test organism, if possible, and one should give the essential oil composition or describe precisely under which conditions the oil was obtained.

Whilst Janssen's work was academically appropriate, i.e. requiring reproducible test results, unfortunately the American medical and scientific communities generally ignored the opportunity to continue credible research with essential oils. Eldon M. Boyd, M.D. of Canada, was very active in his research of essential oils and the respiratory tract. In 1968, he and Sheppard[4] reported that steam inhalation of volatile oils could increase the volume of mucus expectorated. However, his method caused a great deal of side effects. The essential oils were dissolved in large volumes of alcohol and the reported deaths to his test animals were in the end attributed to inhaling the large volumes of alcohol and not specifically to the essential oil. Later in 1970 in "The Journal of Pharmacology

and Experimental Therapeutics" Boyd, et al.[5] showed that Nutmeg Oil and Camphene could be used as Inhaled Expectorants. The doses that produced the most mucous secretion were doses where the odor of nutmeg was either undetected, or only slightly detectable. As the detectable odor increased, the mucous secretion began to decrease. Boyd also concluded that "systemic expectorants were usually taken by mouth and very few of them, including the popular guaicolate, can be demonstrated to have pharmacological expectorant activity except occasionally in high and toxic doses. Inhaled expectorants act by stimulation of mucus-secreting cells in the respiratory tract and since the action is local, it can often be produced by very small and well-tolerated amounts of the inhalant."

Burrow, et al.[6] in a report entitled "The Effects of Camphor, Eucalyptus and Menthol Vapor on Nasal Resistance to Airflow and Nasal Sensation" showed that there was an increase in air flow and nasal sensation. The title of the article, inspite of the positive results, appeared to cast doubts on the validity of the medicinal value of essential oils.

The RESEARCH REPORT by Knobloch, et al.[7] showed the confusion caused by the way that the essential oils were tested. Tests on drugs are commonly conducted in a water soluble solution that is then placed on the bacteria and fungal cultures. The results of the "kill zone" are then read. Since many of the essential oils are not water soluble, testing by this method resulted in mixed results. "Numerous different terpenoid compounds inserted seemed to indicate that their aseptic potency was found to be more powerful the better the compound is soluble in water... On the other hand, there are phenolic alcohols, like thymol, carvacrol and eugenol aromatic aldehydes, especially cinnamaldehyde which appear less water soluble but more powerful in antiseptic properties. ... In general, essential oils caused damage to a biological membrane due to their lipophilic properties." Since the essential oils did not fit into the testing procedures already in place the results were not credibly received.

A large amount of research during the 1980's was conducted by the biology departments of universities to determine if the essential oil vapors could be used to inhibit the growth of mold, and other bio-organisms during the transportation and preservation of food[8, 9, 10, 11, & 12]. This research was so specialized that there was not much follow up to this research. Research published in 1989 by R.S. Farag, et al.[13] entitled "Antimicrobial Activity of Some Egyptian Spice Essential Oils" under the heading of "A Research Note" was completed with a great deal of precision. All the issues that were addressed in Janssen's paper were addressed. GVC Pye Unicam gas chromatograph detectors identified the essential oils. The purity of the oils was tested and verified by GLC. Identification of the microorganisms was obtained and the procedure for growing those microorganisms was detailed. The results were reproducible. In fact, R.S. Farag's follow on research showed that thyme and cumin oils remarkably decreased both the total bacterial and lipolytic bacterial counts in butter. The research for the food industry established methods, techniques, and equipment that enabled data to be reproduced and the credibility of the research, as well as the researchers, was established. Much of this research was "direct contact" research. The saturated discs of essential oils were placed directly on the agar that was growing the microorganisms. Very little attempt was used to test the vapor stage of essential oils[14, 15, & 16]. Despite the successful testing, scientific journals continued to minimize the impact of research done with essential oils. The research was treated as a "by the way did you know..." report[17, 18]. Finally, in the mid 1990's the American medical field began to look at antimicrobial activity of essential oils as well as its antitussive effect or cough relief. Instead of looking at the essential oil as the solution to the problem [19, 20], much of the research was looking for that one magic ingredient in the essential oils that would solve the problem, be synthesized, patented, and marketed,

One Japanese researcher took a different look at essential oils. Starting in 1983 with his "Inhibitory Effect of Volatile Constituents of Plants on the Proliferation of Bacteria – Antibacterial Activity of Plant Volatiles – " for the Journal of Antibacterial, Antifungal Agents[21], Shigeharu Inouye began his systematic look at essential oils and their antibacterial activity. Sealed chambers were used in the testing procedure. Plant segments or volatile chemicals from the plants were placed on a separate dish, next to and below the microorganisms that were growing on the culture medium. The orientation dictated that plant vapors were disbursed in the air in the 100x100x100 mm chamber and that any effect from the plants specimens was due only to the vapor stage of those plants. This was Inouye's first documented attempt at testing the true vapors of plant volatiles. Inouye was convinced that the inconclusive and unpredictable nature of past research was due in part because the standard for vapor research was the inverted petri dish. He believed that although the inverted petri dish was convenient it did not allow for a distance large enough between the agar and the lid of the petri dish to determine and control the concentration of essential oils in the vapor stage. He began his quest then to develop a testing method that would generate reproducible data. Inouye continued his research and in 1985 reported in the Journal of Antibacterial, Antifungal Agents[22] that essential oil constituents of allyl isothiocyanate, citral and caprylic aldehyde showed far more potent antifungal activity with gaseous contact than contact by an aqueous solution. The results for antifungal activity were similar to the antibacterial activity reported in his 1983 research. The difference between contact by aqueous solution and contact by gaseous contact were obvious and measurable for both antifungus and antibacterial testing. However, the difference between the two

methods was far more pronounced with the testing for the antibacterial activity. Although Gocho reported that there was no significant antibacterial action of aroma compounds in vapor state in his 1991 paper for Journal of Antibacterial, Antifungal Agents[23], Inouye continued his research. In 2001, in the Journal of Antimicrobial Chemotherapy he reported that essential oils in their gaseous state were effective against respiratory tract pathogens[24]. Inouye concluded that the work by Gocho[25] and others, using the inverted agar medium plate inoculated with test strains at about 5 mm distance, although it was convenient, the air space was too small to measure the vapor concentration of the essential oils. He developed a larger air-tight box with the air capacity of 1 liter and proceeded to test the vapor stage against the respiratory tract pathogens of H. influenzae ATCC 33391, S. pyogenes ATCC 12344, S. pneumoniae IP-609, S. pneumonia PRC-53, S. aureus FDA 209P JC-1, and E. coli NIHJ JC-2. Results indicated that the antibacterial action of essential oils was most effective when at high vapor concentration for a short time.

Dr. Inouye next shifted his research to determine the "Effect of Sealing and Tween 80 on the Anitfungal Susceptibility Testing of Essential Oils"[26]. The results of this study indicated that concentrations of essential oils showing high volatility decreased substantially in broth and agar media when incubated under open conditions. This was the first research that showed that the type of medium that the microorganisms was grown on/in could affect the data. This was not due to the speed that the microorganisms grew or how healthy the organisms were, the mediums absorbed the essential oils, and also drastically decreased the volatility of the essential oils. In fact the decrease in the half-life of the essential oils was from 0.7 to 38 hours in broth medium at 27° C. When evaporation was prevented by sealing, MIC (minimum inhibitory concentration) values against Aspergillus fumigatus, Candida albicans and Trichophyton mentagrophytes by broth or agar dilution assay were lowered two to eight-fold, as compared with those obtained under open conditions. Addition of Tween 80 caused a rise of the MIC's against A. fumigantus by two to four-fold in broth dilution assay, but had little affect on the MIC's in agar dilution assay.

In Inouye's report in the Journal of Infection and Chemotherapy[27] in December 2001, he reflects on the difficulties of studying essential oils. He reports that scientific investigation of the antimicrobial activity of essential oils has been retarded by the lack of appropriate susceptibility testing methods for these oils, and no generally approved assay method has been established to accurately determine their antimicrobial activity. Inouye referred to Janssen's conclusions. Many researchers have employed the disc assay method, the results of which were not always in parallel with those of dilution assay methods[3]. However, his research indicates that the differences were caused not only by differences in the solubility of the oils, but by interactions of the components in the concentrated solution used in the disk assay. He felt that the dilution method could be more reliable than the disk method with regard to reproducibility and clinical relevance. The non-water-soluble and highly volatile essential oils that were that were tested with the dilution method had to use chemical emulsifiers such as Tween 80 for this homogenization, but Inouye and others found that these emulsifiers reduced the bioactivity of the oils most likely due to the formation of micelles, which inhibit adequate contact between the oil and the test organism. Research indicates that the use of agar as a chemically and microbiologically inert stabilizer will minimize this issue. With reference to his work with Tween 80, it was found that the minimum inhibitory concentration (MIC) values of essential oils have been obtained, in many instances, under open conditions of incubation. Inouye's results showed that the incubation under open conditions caused a two-to-eight fold rise in the MIC's of highly volatile oils, as compared with values obtained under sealed conditions. In other words, this showed that you did not need the previously believed large doses of the essential oils to achieve the desired antibacterial and antifungal results.

For generations Aromatherapists, parents, grandparents, and knowledgeable caregivers have known that the inhalation of essential oils, usually in a salve or by steam inhalation, was one of the best treatments for respiratory infections? Not only does Inouye's last three papers prove that the inhalation of essential oils is effective against respiratory pathogens, but it shows that the most effective delivery system is with short concentrated bursts of the essential oil vapors. This is exactly the delivery mechanism of a personal inhaler. At this current time, there is a proposal that has received preliminary approval for the study of inhaling antiseptic essential oil vapors to prevent, treat, and cure SARS, and TB[28]. This research will test Eucalyptus globules, Melaleucia alternifolia, and Eucalyptus citriodora against the virus' that are suspected to cause SARS, the virus' that cause the common colds, common virus' that cause flus, and also the bacteria that causes TB. This research follows the methods that were patented in U.S. Patent No. 6,447,816[29].

With the acceptance of this proposal and the recent research by Inouye and others, aromatherapy has crossed from "feel good" therapy into medical therapy in the eyes of contemporary professionals. Examples of this serious medical testing can be seen in the paper by Federspil, P., et al.[30]. I do not have the entire paper translated as yet, but the translated English abstract shows that trials of 331 patients in double-blind, double-dummy, randomized tests "support the value of essential oils like myrtol as an effective treatment in acute, uncomplicated sinusitis instead of antibiotics as first choice. In the English abstract of a German study in 1990, Salvia officinalis, Lavandula officinalis and other oils were used in the treatment of patients with chronic bronchitis with success[31].

Similarly, in 1994 Savino, A., et al.[32] stated in the English abstract that essential oils were successful in treating various microbial strains of C. albicans, E. coli, and Pseudomonas aeruginosa among others. Thus modern reproducible testing has confirmed what has been known informally for many centuries.

Conclusion

Due to valuable research which has been accomplished over many generations the future of Aromatherapy is exciting. We now have clear testing procedures and reproducible data which set credible benchmarks for Aromatherapy research. Maintaining these high standards of research will bear the proof that Aromatherapy can be of significant benefit in the world of medical treatments and healing. (**References available upon request.)

About Marilyn Vail

Marilyn Vail is President of Inhalation, Inc. She and her husband Banning Vail are the Co-Founders of this 4 year old company. Marilyn is a graduate of the Masters Apprenticeship Program for Aromatic Studies taught by The Northwest College for Herbal and Aromatic Studies, and a member of NAHA. Her scientific training brings technical validation to the knowledge that aromatherapists have known for years.

Inhalation Inc. is the result of several years of research to find an easy method to prevent respiratory infections for Co-Founder Banning Vail. He had lost 1/3 of his lungs to MRSA and was warned that if he had another infection in his lungs, he would most likely end up on the oxygen tank.

Marilyn also is founder of Essentially For You. This aromatherapy company has many interesting products and she is extremely proud of her Hand and Body Cream. The products and treatments of this company have grown out of her own needs and also the needs of her clients.