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The efficacy of Aromatherapy in prevention of herpes simplex virus infections

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The results of the research conducted in the recent years demonstrate that essential oils obtained from some plants show strong virucidal activity against many pathogenic microorganisms and thus they may play a supportive role in the prevention of infections caused by the herpes simplex virus (HSV). Among others, these viruses may infect the central nervous system – most commonly via the airborne route or through a direct contact with the affected skin (HSV-1) or as a result of virus transmission via the genitals, the genitourinary tract, anus and the skin of the inferior parts of the body (HSV-2). The purpose of our work was to present aromatherapy as a safe method supporting the medical prevention of infections caused by the herpes simplex viruses. This work has been written based on a narrative review of the world scientific literature.

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Encephalitis is a neurological syndrome with clinical symptoms of brain function disturbances[1]. According to the statistical data, encephalitis incidence ranges from 3.5 to 7.4 cases per one hundred thousand people. Viruses are the most common aetiological factor causing central nervous system infections[2]. More than 100 viruses have been identified until now that may lead to disease development[3]. Most commonly, type 1 and 2 herpes simplex viruses are involved: HSV-1 – herpes simplex virus 1 (HHV-1-Human Herpes virus 1) and HSV-2 – herpes simplex virus 2 (HHV-2 – Human Herpes virus 2) as well as the following: the Varicella Zoster Virus (VZV); the Epstein Barr Virus (EBV) – causing mononucleosis; the Nipah virus; the Australian Bat Lyssa virus (ABLV), and also enteroviruses (predominantly enterovirus 71), arboviruses, such as the West Nile Virus (WNV), the Japanese Encephalitis Virus (JEV) and the Tick-Borne Encephalitis Virus (TBEV)[4].

Herpes simplex viruses have diameters of about 200 nm and are built of a single chromosome containing double-stranded deoxyribonucleic acid enclosed within a protein capside, tegument and glycoprotein envelope. The difference between HSV-1 and HSV-2 genetic material is about 5 %, but this results in significant differences in the course of infection. HSV-1 infection may occur already in the early period of life. Among the US black population, specific antibodies are detected in about 30 % of children aged 5 yrs and in about 70-80 % of adolescents[5,6]. The patient gets infected via the airborne route or through a direct contact with the skin affected by the inflammatory process. Pathological lesions localise around the mouth and eyes and in the throat and oesophagus[7]. HSV-2 infections are less common in the USA and affect 20-30 % of people aged 15 – 29 yrs, increasing up to 35 – 60 % in people aged 60 yrs[5]. The infection is a consequence of a virus transmission via the genitals and affects predominantly the urogenital tract, the anus and the skin of the lower half of the body[6].

After the initial infection, HSV-1 and HSV-2 lie latent in the central nervous system[8]. They become reactivated under such initiating factors as: stress, warm or cold temperature, fatigue, fever, bacterial infection, local and systemic immunosuppression, hormonal disorders, UV radiation, laser procedures or trauma. These factors may affect cell proteins that directly initiate activation of viral genome transcription or inhibit the effect of hypothetical replication inhibitors[9]. Thus, it is thought that the majority of encephalitis cases induced by HSV are not an effect of initial infection but they result from reactivation of

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the latent form of the virus[10].

The exact incidence of herpes simplex encephalitis (HSE) is unknown and it is estimated to be 1 to 4 cases per one million people per year[10,11]. It was found that HSV-1 is the most common cause of encephalitis in adults and older children, and HSV-2 causes, in the majority of cases, lymphocytic meningitis, myelitis or radiculitis showing a mild course[6,8]. Numerous observations and studies confirm that in spite of rare occurrence this disease is considered one of the most serious diseases of the nervous system[8,12]. The death rate among patients with appropriate treatment reaches 30 % and among untreated patients it is as high as 70 %. In a substantial part of patients HSV infection leaves behind permanent neurological disorders, and only 2-5 % of patients achieve a full recovery[8].

At present, many treatments are used in the treatment of herpetic encephalitis, and some of them lead to inhibition of the growth of the virus or to its elimination. The highest efficacy is observed for the therapies including acyclovir (acycloguanosine; 9-[(2-hydroxyethoxy) methyl] guanine; $C_8H_{11}N_5O_3$) and its derivatives that block one of the enzymes of the virus and inhibit DNA replication[13]. Adverse events are relatively common during the treatment, including, but not limited to: nausea, vomiting, hypersensitivity to light, abdominal pain and diarrhoea. The observation of growing resistance of this virus to the drugs received by the patients and decreasing treatment efficacy lead to continuous search for natural therapeutic agents inhibiting the action of this microorganism[14]. Studies conducted in the recent years have proven that some plant-derived products may have a supportive role in the prevention and treatment of infections caused by the herpes simplex virus.

Aim of the work

The aim of our work was to present aromatherapy as a method supporting the medical prevention of infections caused by the herpes simplex viruses. This work is a narrative review based on the search of the world scientific literature. Due to the low number of publications found in data bases the authors did not decide to perform a formal systematic review.

Aromatherapy

The International Federation of Aromatherapists and the Polish Aromatherapy Society qualify aromatherapy as a traditional method of the natural medicine, where natural plant-derived essential oils are used as active substances[15]. They are isolated mainly from the fruits, leaves, seeds and roots, predominantly by steam distillation[16]. Intense scent and multidirectional biological activity are typical features of the essential oils. They are used as natural fragrances in perfume compositions and food flavours, but most commonly they are used for therapeutic purposes[17].

From the chemical point of view, essential oils are multi-ingredient mixtures of monoterpene, sesquiterpene and diterpene compounds (terpene oils) or phenylpropane derivative compounds (non-terpene oils). The compounds found in these mixtures belong to hydrocarbons, alcohols, aldehydes, ketones, esters and ethers. Besides terpene compounds and phenylpropane derivatives listed above, essential oils may also contain sulphuric (mustard oils) and nitrogenic substances, acetylene derivatives, tropolones, coumarins, organic acids and other[18]. Essential oils may be introduced into the organism by two routes[19,20]:

(a) Via the respiratory tract (inhalations, aromatherapeutic chimneys) – aromatic molecules introduced into the nasal cavity along with the inspired air dissolve in the mucus covering the epithelium of the nasal mucosa in the olfactory area. There are neuro-sensory cells in this epithelium that simultaneously receive stimuli and conduct nerve impulses to the olfactory bulb and then to higher levels of the nervous system;

(b) Via the skin (cataplasms, compresses, baths) – it is believed that small sizes of the compounds of the essential oils make them able to penetrate through the skin, predominantly through hair follicles and sebaceous and sweat glands.

Review of the literature on the efficacy of aromatherapy in the treatment of herpetic encephalitis caused by herpes simplex virus infection

Many plant extracts containing essential oils show a strong virucidal effect on pathogenic microorganisms, including the herpes simplex virus (Table 1)[22,23,25,31]. Water extracts from oil plants, such as peppermint or geranium, have been used with high efficacy until now[23,32]. After application of 6 % gel containing tea tree oil, Carson *et al*. have observed a significant reduction of duration of symptoms caused by HSV-2[33]. Astain *et al*. have found that thyme, sandal and hyssop oils destroy the structural coating of the virus. The inhibitory effect on the HSV activity occurs before or during its absorption, which is confirmed by the results of *in vitro* studies, where these oils were used in

Table 1 — Essential oils with anti-viral effect against the herpes simplex virus[21-30]

Author	Essential oil	Botanical plant/family	Basic biologically active substances	The content of the biologically active substance (%)
Schnitzler *et al*.	Tea oil	*Melaleuca alternifolia* Cheel./Myrtaceae	terpinen-4-ol	29 – 45
			γ-terpinene	18 – 23
			α-terpinene	8 – 11
			1,8-cineole	2 – 16
Angioni *et al*.	Eucalyptus oil	*Eucalyptus globules* Labill./Myrtaceae	1,8-cineole	65 – 70
			α-pinene	14.7
			limonene	3.0
Schuhmacher *et al*.	Mint oil	*Mentha piperita* L./Lamiaceae	menthol	42.8
			menthone	14.6
			isomenthone	5.9
Allahverdivey *et al*.	Lemon balm oil	*Melissa officinali*s L./Lamiaceae	citral a	6.62 – 20.13
			citral b	5.82 – 13.58
			caryophyllene	14.24 – 17.31
Koch *et al.*	Anise oil	*Pimpinella anisum* L./Apiaceae	anethole	89.1
Koch *et al*.	Thyme oil	*Thymus vulgaris* L./Lamiaceae	thymol	40.5
			p-cymene	23.6
Koch *et al*.	Sandal oil	*Santalum album* L./Santalaceae	α-santalol	52.5
			β-santalol	20.5
Koch *et al*.	Ginger oil	*Zingiber officinale* Roscoe/Zingiberaceae	zingiberene	18.9
			limonene	15.5
			camphene	6.2
Koch *et al.*	Hyssop oil	*Hyssopus officinalis* L./Lamiaceae	isopinocamphone	13.2 – 43.3
			pinocamphone	14.9 – 38.4
			pinocarvone	0.7 – 20.3
Koch *et al*.	Camomile oil	*Matricaria chamomilla* L./Asteraceae	α-bisabolol	27.4 – 60
			bisabolol oxide	2 -60
			chamazulene	2 – 23.35
			farnesene	2.60 – 40
Cawaleiro *et al*.	Prickly juniper oil	*Juniperus oxycedrus* L./Cupressaceae	α-pinene	60.60
			β-myrcene	24.97
			γ-muurolene	5.19
Chaieb *et al.*	Clove oil	*Syzygium aromaticum* L./Myrtaceae	heptan-2-one	0.05
			caryophyllene	6.57
			α-humulene	1.53
			eugenol	80.19
Standen *et al.*	Cranesbill oil	*Pelargonium graveolens* L'Her./Geraniaceae	geraniol	12.6
			citronellol	23.1
Pierozan *et al.*	Sage oil	*Salvia officinalis* L./Limiaceae	camphor	20-30
			1,8-cineole	15-30
			borneol	3-15
			β-pinene	4-7
Sunden *et al.*	Cedar wood oil	*Cedrus libani* A. Rich/Pinaceae	β-himachalene	41.9
			α-himachalene	15.7
			γ-himachalene	9.7
			δ-cadinene	2.2

various developmental stages of the virus during infection[34]. A similar opinion was presented by Schnitzler *et al.* who have found no antiviral effect of the lemon balm oil if it was used after completion of body cell infection or during intracellular replication of the virus. These authors have observed a moderate reduction of HSV-1 (by 64.8 %) and HSV-2 (by 39.9 %) when they were treated with lemon balm oil during their absorption[35]. Other studies demonstrate that essential oils from the fruits of prickly juniper and from Lebanon cedar wood are also active against HSV-type viruses[36]. Garcia *et al*., in turn, suggest that

the oils from holy rope and from plants of the *Artemisia* genus limit the infection most probably through an interaction with the glycoprotein capsule of the virus, thus impairing its ability to infect body cells[37]. Armaka *et al*. have shown that isoborneol present in the sage oil inhibits glycosylation of the viral proteins before the virus enters the body cells. Inhibition of HSV glycosylation may be related to physiological and structural changes in cells in the course of an infection[38]. Silvepropolus *et al.,* have shown that also other monoterpene compounds present in the sage oil, such as 1,8-cineole or thujone, have a similar impact[39]. Having analysed the antiviral effects of selected essential oil ingredients, such as: borneol, linalool, menthol, geraniol, ciral, limonene, eugenol or thymol (from sage and mint, as well as from geranium, lemon balm, ginger, clove, and thyme oils) eugenol ($C_{10}H_{12}O_2$) was found to be the most potent[40]. *In vitro* studies performed by Benencie & Courreges have demonstrated that eugenol, which is the principal monoterpene of the clove oil, inhibited the development of HSV-1 and HSV-2, at concentrations of 25.6 μg/mL and 16.2 μg/mL, respectively. Application of eugenol in an experiment *in vivo* significantly delayed the development of viral conjunctivitis in mice (HSV-1 causes cold sores around the eyes). When eugenol was administered into the conjunctival sac at a concentration of 1 mg/mL the symptoms of viral infection appeared as late as in the 10th day after the infection. Additionally, Benencia & Courrèges have demonstrated that application of essential oils in combination with acyclovir enhances its antiviral effect. The synergistic activity of the combination of acyclovir and eugenol had a stronger inhibitory effect on HSV replication *in vitro*. The highest synergism was observed by them at low concentrations of acyclovir (0.07 and 0.15 μg/mL) and higher concentrations of eugenol: 120μg/mL (HSV-1) and 30 and 60 μg/mL (HSV-2)[41].

Conclusion

Starting from the assumption that the majority of disease cases caused by the herpes simplex virus are not the result of primary infection but of its reactivation from the latency status, aromatherapy is perceived as a method that may prevent virus activation. Some plant-derived essential oils have high contents of biologically active substances and owing to this fact they show strong virucidal activity at various virus development stages. The researchers proved the positive effects of essential oils, both in *in vitro* and *in vivo* studies. Direct effects of essential oils alone and of combinations of the oils with pharmacological treatment were proved. These facts made the authors of this work to present aromatherapy as a supportive treatment that is useful in prevention of diseases caused by HSV.

References

1 Tunkel AR, Glaser CA, Bloch KC, Sejvar JJ, Marra CM, Roos KL, Hartman BJ, Kaplan SL, Scheld WM & Whitley RJ, The management of encephalitis: clinical practice guidelines by the Infectious Diseases Society of America, *Clin Infect Dis*, 47(3) (2008) 303–327.

2 Granerod J & Crowcroft NS, The epidemiology of acute encephalitis, *Neuropsychol Rehabil*, 17(4-5) (2007) 406–428.

3 Ferrari S, Toniolo A, Monaco S, Luciani F, Cainelli F, Baj A, Temesgen Z & Vento S, Viral encephalitis: Etiology, clinical features, diagnosis and management, *Open Infectious Dis J*, 3 (2009) 1–12.

4 Donoso Mantke O, Vaheri A, Ambrose H, Koopmans M, de Ory F, Zeller H, Beyrer K, Windorfer A & Niedrig M, Analysis of the surveillance situation for viral encephalitis and meningitis in Europe, *Euro Surveill*, 13(3) (2008) 1–10.

5 Whitley RJ & Roizman B, Herpes simplex virus infections, *Lancet*, 357(9267) (2001) 1513–1518.

6 Zajkowska JM, Hermanowska-Szpakowicz T, Pancewicz SA, Kondrusik M & Grygorczuk S, Herpes simplex encephalitis, *Pol Neurolog Rev*, 2 (2006) 22–26.

7 Whitley RJ & Kimberlin DW, Herpes simplex encephalitis: children and adolescents, *Semin Pediatr Infect Dis*, 16(1) (2005) 17–23.

8 Steiner I, Kennedy PG & Pachner AR, The neurotropic herpesviruses: herpes simplex and varicella-zoster, *Lancet Neurol*, 6(11) (2007) 1015–1028.

9 Mertz GY, Rosenthal SL & Stanberry LR, Is herpes simplexvirus type 1 (HSV-1) now more common than HSV-2 in first episodes of genital herpes, *Sex Transm Dis*, 30(10) (2003) 801-802.

10 Whitley RJ, Herpes simplex encephalitis: adolescents and adults, *Antiviral Res*, 71(2-3) (2006) 141–148.

11 Stahl JP, Mailles A, Dacheux L & Morand P, Epidemiology of viral encephalitis, *Med Mal Infect*, 41(9) (2011) 453–464.

12 Whitley RJ & Gnann JW, Viral encephalitis: familiar infections, and emerging pathogens, *Lancet*, 359 (9305) (2002) 507–513.

13 Pasternak B & Hviid A, Use of acyclovir, valacyclovir, and famciclovir in the first trimester of pregnancy and the risk of birth defects, *J AM Med Asso*, 304 (8) (2010) 859-866.

14 Whitley RJ & Gnann JW, The incidence and severity of herpes simplex encephalitis in Sweden, 1990–2001, *Clin Infect Dis*, 45(7) (2007) 881–882.

15 Kiełtyka – Dadasiewicz A & Gorzel M, Alternative therapies. Aromatherapy – raw materials and treatments, *Eur J Med Technol*, 1(2) (2014) 72-79.

16 Messager S, Hammer KA, Carson CF & Riley TV, Assessment of the antibacterial activity of tea tree oil using the European EN 1276 and EN 12054 standard suspension tests, *J Hosp Infect*, 59 (2005) 113-125.

17 Fabio A, Cermelli C, Fabio G, Nicoletti P & Quaglio P, Screening of the antibacterial effects of a variety of essentials

oil on microorganisms responsible for respiratory infections, *Phytother Res*, 21(4) (2007) 374-377.

18 Bakkali F, Averbeck S, Averbeck D & Idaomar M, Biological effect of essentials oils – a review, *Food Chem Toxicol*, 46 (2) (2008) 446-475.

19 Suschke U, Sporer F, Schneele J, Geiss HK & Reichling J. Antibacterial and cytotoxicactivity of *Nepeta cataria* L., *N. cataria* var. *citriodora* (Beck.) Balb. and *Melissa officinalis* L. essential oils, *Nat Prod Comm*, 2(12) (2007) 1277–1286.

20 Breer H, Olfactory receptors: molecular basis for recognition and discrimination of odors, *Anal Bioanal Chem*, 377 (2003) 427–433.

21 Schnitzler P, Schön K & Reichling J, Antiviral activity of Australian tea tree oil and eucalyptus oil against herpes simplexvirus in cell culture, *Pharmazie*, 56 (4) (2001) 343-347.

22 Angioni A, Barra A, Coroneo V, Dessi S & Cabras, P, Chemical composition, seasonal variability, and antifungal activity of Lavandulastoechas L. ssp. stoechas essential oils from stem/leaves and flowers, *J Agric Food Chem*, 54 (12) (2006) 4364-4370.

23 Schuhmacher A, Reichling J & Schnitzler P, Virucidal effect of peppermint oil on the enveloped viruses herpes simplex virus type 1 and type 2 *in vitro*, *Phytomedicine*, 10 (6-7) (2003) 504-510.

24 Allahverdivey A, Duran N, Ozguven M & Koltas S, Antiviral activity of volatile oils of *Melissa officinalis* L. against Herpes simplexvirus type-2, *Phytomedicine*, 11(7-8) (2004) 657-661.

25 Koch C, Reichling J, Schneele J & Schnitzler P, Inhibitory effect of essential oils against herpes simplex virus type 2, *Phytomedicine*, 1(1-2) (2008) 71-78.

26 Cavaleiro C, Pinto E, Goncalves MJ & Salqueiro L, Antifungal activity of *Juniperus* essential oils against dermatophyte, *Aspergillus* and *Candida* strains, *J Appl Microbiol*, 100 (2006) 1333-1338.

27 Chaieb K, Hajlaoui H, Zmantar T, Kahla-Nakbi AB, Rouabhia M, Mahdouani K & Bakhrouf A, The chemical composition and biological activity of clove essential oil, *Eugenia caryophyllata* (*Syzigium aromaticum* L. Myrtaceae): a short review, *Phytother Res*, 21 (2007) 501.

28 Standen MD, Connellan PA & Leach DN, Natural killer cell activity and lymphocyte activation: Investigating the effects of a selection of essential oils and components *in vitro*, *Int J Aromather*, 16 (2006) 133-139.

29 Pierozan MK, Pauletti GF, Rota L, Atti dos Santos AC, Lerin LA, di Luccio M, Mossi AJ, Atti-Serafini L, Cansian RL & Oliveira JV, Chemical characterization and antimicrobial activity of essential oils of *Salvia* L. species, *Ciênc Tecnol Aliment*, 29(4) (2009) 764-770.

30 Sunden MD, Connellan PA & Leach DN, Natural killer cell activity and lymphocyte activation: Investigating the effect of a selection of essential oils and components *in vitro*, *Int J Aromather*, 16 (2006) 133-139.

31 Goswami D, Mukherjee Pulok K, Kar A, Ojha D, Somdatta Roy S & Chattopadhyay D, Screening of ethnomedicinal plants of diverse culture for antiviral potentials, *Indian J Tradit Knowle*, 15(3) (2016) 474-481.

32 Schnitzler P, Schneider S, Stintzing FC, Carle R & Reichling J, Efficacy of an aqueous Pelargonium sidoides extract against herpes virus, *Phytomedicine*, 15(12) (2008) 1108-1116.

33 Carson CF, Hammer KA & Riley TV, *Melaleuca alternifolia* (tea tree) oil: a review of antimicrobial and other medicinal properties, *Clin Microbiol Rev*, 19 (1) (2006) 50-62.

34 Astani A, Reichling J & Schnitzler P, Comparative study on the antiviral activity of selected monoterpenes derived from essential oils, *Phytother Res*, 24 (5) (2010) 673-679.

35 Schnitzler P, Schuhmacher A, Astani A & Reichling J, *Melissa officinalis* oil affects infectivity of enveloped herpes viruses, *Phytomedicine*, 15 (9) (2008) 734-740.

36 Kim SS, Oh OJ, Min HY, Park EJ, Kim Y, Park HJ, Nam Han Y & Lee SK, Eugenol suppresses cyclooxygenase-2 expression in lipopolysaccharide-stimulated mouse macrophage RAW264.7 cells, *Life Sci*, 73(3) (2003) 337-348.

37 García CC, Talarico L, Almeida N, Colombres S, Duschatzky C & Damonte EB, Virucidal activity of essential oils from aromatic plants of San Luis, Argentina, *Phytother Res*, 17(9) (2003) 1073-1075.

38 Armaka M, Papanikolaou E, Sivropoulou A & Arsenakis M, Antiviral properties of isoborneol, a potent inhibitor of herpes simplex virus type 1, *Antiviral Res*, 43 (2) (1999) 79-92.

39 Sivropoulou A, Nikolaou C, Papanikolaou E, Kokkini S, Lanaras T & Arsenakis M, Antimicrobial, cytotoxic, and antiviral activities of *Salvia fructicosa* essential oil, *J Agric Food Chem*, 45 (8) (1997) 3197-3201.

40 Minami M, Kita M, Nakaya T, Yamamoto T, Kuriyama H & Imanishi J, The inhibitory effect of essential oils on Herpes simplex virus type-1 replication *in vitro*, *Microbiol Immunol*, 47(9) (2003) 681-684.

41 Benencia F & Courrèges MC, *In vitro* and *in vivo* activity of eugenol on human herpes virus, *Phytother Res*, 14 (7) (2000) 495-500.