

The use of carrier oils in aromatherapy massage and their effect on skin

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Abstract

Aromatherapy massage is a treatment in which essential oils are used. It combines the beneficial effects of manual massage technique, essential and carrier oils. Base oils are the mediators of aromatherapy; they improve contact between the masseur's hands and the patient's body and have nurturing properties. The present paper focuses on plant oils used for aromatherapy massages, such as olive, sesame, jojoba, almond, wheat germ, grape seed or peach oils.

Key words: massage, essential oils, plant oils, skin

Introduction

People have been interested in care of health and beauty for ages. An important element of this care is massage, which is inseparably associated with hygiene, cosmetic treatments, biological and mental regeneration. Classical massage, in which stroking, kneading, rubbing, tapotement and shaking are used in a definite sequence and rate, is to affect the locomotor system, skin, connective tissue, adipose tissue and indirectly internal organs. It results in therapeutic and relaxing effects [1, 2, 3, 4]. In order to enhance the effects of massaging on the human body, some additional substances can be applied, including essential oils [4]. Numerous recent studies have confirmed therapeutic effects and possible uses of essential oils in massages [5, 6, 7, 8].

Aromatherapy massage, also called fragrant massage is a treatment performed using essential oils to introduce active substances into the human body. The skin extremely easily absorbs oils, which during massaging permeate quickly the cardiovascular system, inducing local and general reactions [9]. The effects of aromatherapy massage on the body and skin are multidirectional.

Aromatherapy massages relax, calm, reduce stress, relieve pain, enhance immunity, restore body-mind balance, smoothen and tone the tissues [5, 7, 10, 11, 12]. Such massages are most commonly associated with relaxing massages; however, studies have also demonstrated their therapeutic effects [10, 11, 12, 13, 14]. The study conducted in a group of 40 individuals undergoing massages with the mixture of lavender and bergamot oils has confirmed their positive effects on the mental status and provided evidence for their use to treat depression or anxiety [11]. According to Ćwirlej et al. [13], the aromatherapeutic massage exerts better analgesic effects, as compared to the classical massage and is particularly useful for relieving pain when pharmacological agents are not recommended [14]. The essential oils of antioxidant properties, which improve the lymph circulation and detoxify the body (e.g. ginger, rosemary, clary sage, cypress, geranium, juniper or sandal oils) can also be used for enhancing the effects of lymphatic massage [15].

Aromatherapy massages combine the beneficial effects of touch with the properties of essential and carrier oils. The main techniques used in such massages are stroking and rubbing. In professional

massages, 15-30 drops of essential oils are used together with 50 ml of plant oil. The oil or a mixture of selected essential oils is applied for massaging the entire body or for partial massaging, whenever the former is contraindicated. The selection of an appropriate oil depends on the effect the treatment is to induce [9] (Table 1).

The oil or a mixture of oils chosen for the treatment should be dissolved in an appropriate carrier, most commonly in natural plant oils. Carriers for aromatherapy massage have to dissolve essential oils well, should be fresh and preferably odourless [20]. Carrier oils of high quality, in other words base oils, are not only the mediators of aromatherapy but also facilitate the distribution of a small amount of the essential oil over the larger body area, improve contact between the masseur's

hands and the patient's body and have nurturing properties [16,21]. Plant oils rich in essential fatty acids (EFAs), phytosterols, fat-soluble vitamins and other bioactive constituents have moisturising, lipid-replenishing, regenerative, anti-oxidative, anti-seborrhoeic, anti-wrinkle and protective effects [22] (Table 2). Thanks to EFAs (beside ceramides and cholesterol) are part of the intercellular cement, the skin can be an effective barrier limiting transepidermal water loss (TEWL), providing a suitable level of epidermal hydration and protecting the skin against external factors [23, 24].

The most valuable plants oils used for aromatherapy massages include olive, sesame, sunflower, jojoba, sweet almond, wheat germ, grape seed and peach oils [9, 21].

Table 1. Examples of essential oils used for massages and skin care

Kind of treatment/indications	Essential oils
harmonising	geranium, rose tree, grapefruit, neroli, Roman chamomile, sandalwood
stimulating	lemon, ginger, rosemary
relaxing	sandalwood, rose tree, geranium, neroli
calming	lavender, Roman chamomile, sandalwood
toning	colander, pepper, grapefruit, clary sage, ylang-ylang
anti-cellulite	juniper, rosemary, patchouli, cedar, grapefruit, cypress, geranium, ginger, cinnamon
slimming	rosemary, cypress, geranium, lemon, ginger
dry skin	geranium, neroli, rose, Roman chamomile, sandalwood, jasmine
oily skin, acne skin	lemon, cypress, tea tree, lavender, Roman Chamomile, bergamot, sandalwood, copaiba, jeju
combination skin	geranium, ylang-ylang
sensitive skin	rose tree, lemon, lavender, Roman chamomile, sandalwood, geranium
couperose skin	neroli, rose, Roman chamomile, cypress, sandalwood
mature skin	rose, lemon, rosemary, neroli, geranium, sandalwood

The source: [9, 16, 17, 18, 19]

Table 2. Examples of base oils used for skin massages and care

Indications	Plant oils
dry and sensitive skin	avocado oil, apricot kernel oil, wheat germ oil, almond (sweet) nut oil, kukui (candle nut) oil, macadamia nut oil, green coffee oil, jojoba oil, marula oil, linseed oil, blackcurrant seed oil, olive oil
oily, combination, acne skin	babassu oil, chaulmoogra oil, baobab oil, sesame oil, evening primrose oil, borage oil, linseed oil, rosehip seed oil, sesame oil, sunflower oil, grape seed oil
mature skin, with the signs of ageing	rice bran oil, wheat germ oil, corn germ oil, soybean oil, rosehip seed oil, green coffee oil, grape seed oil, avocado oil, olive oil, coconut oil, sweet almond oil, sesame oil, argan oil
skin of children and infants	sunflower oil, evening primrose oil, borage oil, linseed oil, olive oil

The source: [22]

Olive oil

Olive oil obtained from common olive (*Olea europaea* L.) belongs to the *Oleaceae* family. It contains palmitic acid (11.5%), oleic acid (72.8%), linoleic acid (10.8%), and linolenic acid (0.2%) [25]. The phenolic compounds contained in olive oil show several biological activities [26]. Olive oil and its beneficial properties were well known to the ancient world. Olive oil was used for care as its external application affected the skin elasticity and protected against UV radiation. In ancient Greece, massage with olive oil was used for therapeutic purposes as an analgesic and as a preventive measure for averting sports injuries. It was believed that massages based on olive oil used after physical activity resulted in faster recovery of athletes [27]. Thanks to its properties, olive oil can be used as an active constituent or as a base of various cosmetic formulations [28]. Recent studies have confirmed positive effects of olive oil on the skin as it contains not only fatty acids but also tocopherols, phytosterols, phospholipids and squalene naturally occurring in the human skin. Olive oil contains bioactive compounds and is therefore used for topical external folk treatments, e.g. as a remedy for dermatitis, eczema, xerosis, other types of inflammation [26]. *Oleum Olivarum* supports the regeneration of the hydrolipid film, have soothing, anti-inflammatory and skin moisturising effects [29, 30]. The study conducted in a group of one hundred and fifteen full-term, healthy neonates have confirmed that regular external application of olive oil significantly improved *stratum corneum* hydration [25]. Moreover, olive oil is one of the plant oils used for striae [31]. As an ingredient of various preparations, it has nurturing properties, especially in cases of dry and destroyed skin, and shows therapeutic effects when used for massages [29, 32]. The available data have demonstrated positive effects of massages with olive oil on weight gain in premature infants; the average weight

gain was 21 g daily while in infants undergoing massages without olive oil - 7 g [32].

Sesame oil

Sesame oil obtained from *Sesamum indicum* L. belongs to the *Pedalicaceae* family and provides considerable amounts of protein (22%) and high amounts of lipids (52%) [33, 34]. Besides unsaturated fatty acids, sesame oil contains linoleic acid (46.9%) and oleic acid (37.4%), saturated fatty acid, including palmitic (9.1%) and stearic (6.1%) acids. The total tocopherol content in sesame oil is 446 mg·kg⁻¹, including 2.2% of α -tocopherol, 90.5% of γ -tocopherol and 7.3% of δ -tocopherol. Due to the presence of bioactive constituents (including these with anti-oxidative action), sesame oil is a valuable component of pharmaceuticals, nutraceuticals and cosmetics [34]. In Asian countries, sesame oil has long been used for joint pain or toothache relief [33]. Recent studies in animal models have demonstrated analgesic effects of sesame oil in different forms of administration (topical or oral) [35]. Moreover, the available study findings have confirmed the efficacy of sesame oil applied externally with other herbal extracts for relieving pain in patients with migraine, knee osteoarthritis, and burns. Furthermore, its low cost, lack of adverse side effects and easy usage as a complementary method of pain relief in patients with limbs trauma are emphasised [33]. Besides its therapeutic action, *Oleum Sesami* has nurturing properties, such as soothing, moisturising and smoothing. It is used in preparations for dry, sensitive and combination skin as well as in cosmetics for body care and sun protection [22, 34]. Thanks to its emollient properties, it is also considered an excellent agent for massages [36]. Sesame oil penetrates into the skin quickly and enters the blood stream through the capillaries [34]. It has been demonstrated that sesame oil-based massages may have beneficial impact on

newborn health, improved sleep patterns and growth [37].

Sunflower oil

Sunflower oil obtained from the seeds of common sunflower (*Helianthus annuus* L.) belonging to the *Asteraceae* family, provides 19.6% of oil being the source of saturated acids (palmitic (6.3%), stearic (3.5%) and unsaturated acids (linoleic (60.9%), oleic (46.3%)) [38, 39, 40]. The amount of fatty acids in sunflower oil depends on particular climate conditions. Study findings have demonstrated that in cooler climates the production of omega -6 polyunsaturated fatty acids (PUFA), including linoleic acid, is higher while under warmer climate conditions, oleic acid from the group of monounsaturated fatty acids (MUFA) predominates [41]. *Oleum Helianthi* strengthens the skin protective barrier, accelerates wound healing and has anti-inflammatory effects [39]. Massages based on sunflower oil have been found to improve weight gain and enhance the functions of the skin lipid barrier, which favours the reduction of transepidermal water loss and improves thermoregulation, contributing to improved nutrition and better somatic growth [42, 43]. Sunflower oil is recommended for dry and delicate skin as well as oily and acne skin as it belongs to non-comedogenic oils (which do not clog up skin pores). Furthermore, sunflower oil for cosmetic purposes is characterised by a high content of linoleic acid (about 60%) [30, 39]. During massages it functions as a mediator of aromatherapy but also nurtures the skin and has healing, antibacterial and moisturising effects [30].

Jojoba oil

Jojoba oil is obtained from the seeds of jojoba (*Simmondsia chinensis* (Link) C.K. Schneid.) belonging to the *Buxaceae* family. Its seeds contain up to 65% of high-quality golden-yellow,

odourless oil, which is a valuable raw material used in industry, especially in the cosmetic and pharmaceutical ones, and in medicine [44]. Jojoba oil is the only natural source of wax esters [29, 45]. Moreover, it contains high amounts of tocopherols, which affects its antioxidative and radiation-protective properties [46]. The nurturing effects of jojoba wax are associated with its high content of squalene, which has anti-inflammatory, antifungal and antiradical properties [30, 46, 47]. Due to its similarity to natural sebum, jojoba oil is widely used in the cosmetic industry [44]. It is recommended for dry and sensitive skin as well as oily and mature skin [29, 48]. *Oleum Jojobae* is an important element of skincare preparations having moisturising, protective, nourishing and smoothing action [30, 49]. Applied externally jojoba oil leads to a semioclusion of the skin surface, maintains moisture in the skin and reduces TEWL [50]. Its role in cosmetic formulations is essential due to excellent penetrating properties, high stability and resistance to oxidation. Jojoba wax increases absorption, stabilises and prolongs the durability of other ingredients of preparations, including plant oils and butters [44, 49]. Thanks to its anti-inflammatory effects, it is also used in therapeutic preparations for acne, dandruff, burns, including sunburns, and hard-to-heal wounds [49, 51, 52].

Sweet almond oil

Sweet almond oil obtained from the seeds of sweet almond (*Amygdalus communis* L.) belongs to the *Rosaceae* family. Sweet almonds have been cultivated for years, both for nutritional and pharmaceutical purpose [53]. Almonds are a valuable source of dietary lipids ($42.57\text{g}\cdot 100\text{g}^{-1}$) and protein ($18\text{-}20\text{g}\cdot 100\text{g}^{-1}$) [54]. Thanks to the dietary fiber ($10.8\text{-}13.5\text{g}\cdot 100\text{g}^{-1}$), phytosterols ($141\text{mg}\cdot 100\text{g}^{-1}$), including campesterol, stigmasterol and β -sitosterol, minerals (calcium,

copper, iron, magnesium, manganese, phosphorus, potassium, sodium, zinc) and vitamins (tocopherols and tocotrienols, biotin, folate, niacin, pantothenic acid, pyridoxine, riboflavin, thiamine) they contain, almonds contribute to a healthy nutrient profile [53, 54, 55, 56]. Moreover, almonds contain constituents, which have antioxidative properties, including polyphenolic compounds, such as phenolic acids (chlorogenic, gallic, 5-hydroxybenzoic, protocatechuic, coumaric, vanillic), flavan-3-ols (catechin, epicatechin), flavanones (eriodictyol, eriodictyol-7-O-glucoside, naringenin), flavonols (isorhamnetin, kaempferol, quercetin) [57, 58]. The presence of various phenolic acids and flavonoids can contribute to the prebiotic properties of almond [59].

Light yellow, transparent and odourless sweet almond oil contains saturated fatty acids (SFA) ($8.5\text{g}\cdot 100\text{g}^{-1}$), unsaturated fatty acids ($91.6\text{mg}\cdot 100\text{g}^{-1}$), including polyunsaturated fatty acid (PUFA) ($21.7\text{mg}\cdot 100\text{g}^{-1}$) and monounsaturated fatty acid (MUFA) ($69.9\text{mg}\cdot 100\text{g}^{-1}$) [22, 55]. According to the studies using Raman spectroscopy, which assesses penetration and occlusive properties of substances applied externally to the skin, sweet almond oil penetrates only the most external layers of *stratum corneum*. Moreover, it is capable of forming the skin surface film, which protects against excessive loss of water comparably to paraffin oil [60]. *Oleum Amygdalarum* is a valuable well-absorbed substance in cosmetology, which does not induce the effect of heaviness and has moisturising, lipid-replenishing, smoothing and protective properties. It is indicated for the child's skin, in cases of cracked hands and feet and chapped lips [29]. It is particularly recommended for aromatherapy massages of dry and normal skin as well as sensitive and easily irritable skin. Combined with avocado and jojoba oils, sweet almond oil is excellent for extremely dry and damaged skin [9].

Wheat germ oil

Wheat germ oil is obtained from common wheat (*Triticum aestivum* L.) belonging to the *Poaceae* family. Wheat germs contain proteins, sugar, fibre, minerals, thiamine, riboflavin, policosanols, tocopherols, carotenoids and phytosterols [61]. They provide about 11% of oil, which is used in food, pharmaceutical and cosmetic industry [40, 62, 63]. Wheat germ oil is found valuable due to its high content of unsaturated fatty acids (80%), linoleic (56.5%) and linolenic (8.0%) acids, in particular. Compared to other plant oils, it has the highest content of tocopherols (α -tocopherol (70.0%), β -tocopherol (19.0%), γ -tocopherol (7.0%), known as powerful lipid-soluble antioxidants [40, 61, 63]. The phytosterols essential for human physiology, which are present in wheat germ oil include campesterol (27.2%), 5-stigmasterol (0.8%), β -sitosterol (63.0%), isofucosterol (4.0%), 7-stigmasterol (2.0%), 7-avenasterol (3.0%) [40]. Moreover, squalene, the main component of skin surface polyunsaturated lipids, which wheat germ oil contains, is of great importance for skin functioning. Squalene is found to have emollient and antioxidative properties and to ensure proper skin moisture [47]. *Oleum Triticici* is recommended in cosmetology, especially for dry, mature skin which requires regeneration, as it affects its elasticity and prevents ageing. It is used in nourishing and revitalising creams, masks, ampoules and anti-sun preparations [22]. Its density allows to use it for aromatherapy massages combined with other oils, e.g. from sweet almonds [29, 30].

Grape seed oil

Grape seed oil is obtained from grape (*Vitis vinifera* L.) belonging to the *Vitaceae* family. Grape seeds contain about 12% of oil, which is a source of saturated (palmitic (8.0%), stearic (3.0%) and unsaturated (linolenic (0.2%), linoleic (67.8%), oleic (20.2%) fatty acids [29, 40]. Moreover, grape seed oil

contains bioactive ingredients, such as tocopherols and tocotrienols, including α -tocopherol (10.0%) and γ -tocopherol (2.5%), plant sterols, including campesterol (11.4%), 5-stigmasterol (10.5%), β -sitosterol (75.6%), isofucosterol (1.0%), 7-stigmasterol (1.5%), and 7-avenasterol (0.5%). Grape seed oil can be used for pharmaceutical and nutritional purposes [40]. It has antibacterial, antioxidative and anti-inflammatory properties, which is likely to be associated with polyphenolic compounds contained in it [64]. Moreover, it enhances the epidermal barrier, accelerates tissue regeneration, affects wound healing and facilitates absorption of other care preparations [29, 64]. Grape seed oil is used in cases of psoriasis, diaper dermatitis in infants, burns, bedsores or dandruff [29]. As a carrier in aromatherapy massage, it is particularly recommended for normal and oily skin as it affects the composition and consistency of sebum, normalises the function of sebaceous glands and prevents the formation of comedones [9, 29].

Peach oil

Peach oil is obtained from peach (*Prunus vulgaris* Mill.) belonging to the *Rosaceae* family. In comparison with other sources of vegetal oil of high nutritional potential, such as sesame, sunflower, olive, peach oil contains relatively low amounts of palmitic and palmitoleic acids, high content of oleic acid and intermediate content of linoleic acid [65]. The fatty acid profile of peach oil is similar to that of olive oil, mainly because of its high oleic acid content (64%), and to that of almond oil due to its linoleic acid content (26%) [22, 65]. Since it contains high amounts of unsaturated fatty acid as well as antioxidant compounds, peach oil has therapeutic and nutritional properties [65]. Moreover, it is well tolerated by the skin, absorbs easily, softens and smoothens the epidermis [22]. It has been demonstrated that peach oil does not

irritate the skin, and therefore is a recommended carrier of constituents of active cosmetic and pharmaceutical preparations [66]. *Oleum Persicarum* is used for production of milks, lotions as well as bath and massage preparations [22]. It is recommended for all types of skin, for children and elderly individuals, for massages in beauty parlours and spas [30]. Scientific studies have confirmed possible uses of peach oil as base oil. Moreover, there are studies assessing the effects of foot and facial massage using peach-kernel base oil *Prunus persica* on vital signs and sleep induction [67].

Conclusion

Plant oils, being the essential source of unsaturated fatty acids, which cannot be synthesized in the human body, as well as fat-soluble vitamins such as vitamins A, D, E, K and other bioactive compounds, play an important role in food industry, are essential part of human nutrition, and have health-promoting properties. Furthermore, they are important for skin care and its proper functioning. Due to their biological properties (stabilisation of cell membranes, anti-allergic, anti-inflammatory effects), plant oils are widely used in cosmetic recipes as active substances or substances allowing the addition of other substances. Many biologically active substances are soluble in plant oils; therefore, they can be used as carriers of essential oils in aromatherapy massages.

References:

1. Goats G.C. Massage - the scientific basis of ancient art: part 1. The techniques. *Br J Sp Med*, 1994; 28(3): 149-152.
2. Fieldt T. Massage therapy research review. *Complement Ther Clin Pract*, 2016; 24: 19-31.
3. Kennedy A.B., Cambron J.A., Sharpe P.A., Travillian R.S., Saunders R.P. Process for massage therapy practice and essential assessment. *J Bodyw Mov Ther*, 2016; 20: 484-496.

4. Żyżniewska-Banaszczak E., Mosiejczuk H., Cichoński P. Physiotherapy and biological regeneration: for everyone? *Ann Acad Med Stetin*, 2010; 56(3): 113-120.
5. Eto K., Yamazaki A.K., Yonekura K., Mukuda M., Kabasawa Y., Yoshida H., Ito K., Ogiwara M. A preliminary examination of effect of massage and aroma oil massage in foot care nursing. *Procedia Comput Sci*, 2015; 60: 1524-1531.
6. Lai T.K.T., Cheung M.C., Lo C.K., Ng K.L., Fung Y.H., Tong M., Yau C.C. Effectiveness of aroma massage on advanced cancer patients with constipation: A pilot study. *Complement Ther Clin Pract*, 2011; 17: 37-43.
7. Nasiri A., Mahmodi M.A., Nobakht Z. Effect of aromatherapy massage with lavender essential oil on pain in patients with osteoarthritis of the knee: A randomized controlled clinical trial. *Complement Ther Clin Pract*, 2016; 25: 75-80.
8. Taavoni S., Darsareh F., Joolae S., Haghan H. The effect of aromatherapy massage on the psychological symptoms of postmenopausal Iranian women. *Complement Ther Clin Pract*, 2013; 21: 158-163.
9. Konopacka-Brud I., Brud W.S. *Aromaterapia w Gabinetach Kosmetycznym, Ośrodku Odnowy Biologicznej Wellness i Spa*. Warszawa; WSZKiPZ: 2010.
10. Ali B., Al-Wabel N.A., Shams S., Ahamad A., Khan S.A., Anwar F. Essential oils used in aromatherapy: A systemic review. *Asian Pac J Trop Biomed*, 2015; 5(8): 589-598.
11. Hongratanaworakit T. Aroma-therapeutic effects of massage blended essential oils on humans. *Nat Prod Commun*, 2011; 6(8): 1199-1204.
12. Dobetsberger C., Buchbauer G. Actions of essential oils on the central nervous system: An updated review. *Flavour Frag J*, 2011; 26(5): 300-316.
13. Ćwirlej A., Ćwirlej A., Gregorowicz-Cieślak H. Masaż klasyczny i aromaterapeutyczny w bólach kręgosłupa. *Prz Med Uniw Rzesz Inst Leków*, 2005; 4: 366-371.
14. Hur M.H., Lee M.S., Seong K.Y., Lee M.K. Aromatherapy Massage on the Abdomen for Alleviating Menstrual Pain in High School Girls: A Preliminary Controlled Clinical Study. *Evid-Based Compl Alt Med*, 2012; doi: [10.1155/2012/187163](https://doi.org/10.1155/2012/187163).
15. Legan Ł. *Masaż uzdrawiający dotyk*. Białystok; Vital: 2014.
16. Michalak M. Surowce naturalne w gabinetach kosmetycznych i ośrodkach spa. *Cabines*, 2017; 83:74-79.
17. Elshafie H.S., Camele I. An Overview of the Biological Effects of Some Mediterranean Essential Oils on Human Health. *Biomed Res Int*, 2017; doi: [10.1155/2017/9268468](https://doi.org/10.1155/2017/9268468).
18. Michalak M. Aromaterapia w kosmetyce i kosmetologii. *Cabines*, 2014; 64: 32-38.
19. Winkelman W.J. Aromatherapy, botanicals, and essential oils in acne. *Clin Dermatol*, 2018; 36: 299-305.
20. Kiełtyka-Dadasiewicz A., Gorzel M. Alternative therapies. *Aromatherapy - raw materials and treatments*. *Eur J Med Technol*, 2014; 1(2): 72-79.
21. Michalak M. Aromatherapy and methods of applying essential oils. *Arch Physiother Glob Res*, 2018; 22 (2): 25-31
22. Michalak M., Glinka R. Plant oils in cosmetology and dermatology. *Pol J Cosmetol*, 2018; 21(1): 2-9.
23. Feingold K.R., Elias P.M. Role of lipids in the formation and maintenance of the cutaneous permeability barrier. *Biochim Biophys Acta*, 2014; 1841(3): 280-294.
24. Correa M.C., Mao G., Saad P., Flach C.R., Mendelsohn R., Walters R.M. Molecular interactions of plant oil components with stratum corneum lipids correlate with clinical measures of skin barrier function. *Exp Dermatol*, 2014; 23(1): 39-44.
25. Cooke A., Cork M.J., Victor S., Campbell M., Danby S., Chittock J., Lavender T. Olive Oil, Sunflower Oil or no Oil for Baby Dry Skin or Massage: A Pilot, Assessor-blinded, Randomized Controlled Trial (the Oil in Baby Skin care). *Acta Derm Venereol*, 2016; 96: 323-330.
26. Kishikawa A., Ashour A., Zhu Q., Yasuda M., Ishikawa H., Shimizu K. Multiple Biological Effects of Olive Oil By-products such as Leaves, Stems, Flowers, Olive Milled Waste, Fruit Pulp, and Seeds of the Olive Plant on Skin. *Phytother Res*, 2015; 29: 877-886.
27. Nomikos N.N., Nomikos G.N., Kores D.S. The use of deep friction massage with olive oil as a means of prevention and treatment of sports injuries in ancient times. *Arch Med Sci*, 2010; 6(5): 642-645.
28. Ruiz M.A., Arias J.L., Gallardo V. *Skin Creams Made with Olive Oil*. W: Preedy V., Watson R. red., *Olive and Olive Oil in Health and Disease Prevention*, 1st Edition, Academic Press: 2010, pp. 1133-1141.
29. Jędrzejko K., Kowalczyk B., Bacler B. *Rośliny kosmetyczne*. Katowice; SUM: 2007.
30. Lamer-Zarawska E., Chwała C., Gwardys A. *Rośliny w kosmetyce i kosmetologii przeciwstarzeniowej*. Warszawa; PZWŁ: 2012.

31. Soltanipour F., Delaram M., Taavoni S., Haghani H. The effect of olive oil and the Saj® cream in prevention of striae gravidarum: A randomized controlled clinical trial. *Complementary Therapies in Medicine*, 2014; 22: 220-225.
32. Jabraeile M., Rasooly A.S., Farshi M.R., Malakouti J. Effect of olive oil massage on weight gain in preterm infants: A randomized controlled clinical trial. *Niger Med J*, 2016; 57(3): 160-163.
33. Nasiri M., Farsi Z. Effect of light pressure stroking massage with sesame (*Sesamum indicum* L.) oil on alleviating acute traumatic limbs pain: A triple-blind controlled trial in emergency department. *Complement Ther Med*, 2017; 32: 41-48.
34. Gharby S., Harhar H., Bouzoubaa Z., Asdadi A., Yadini A.E., Charrouf Z. Chemical characterization and oxidative stability of seeds and oil of sesame grown in Morocco. *Journal of the Saudi Society of Agricultural Sciences*, 2017; 16: 105-111.
35. Saleem TS, Basha SD, Mahesh G, Sandhya Rani PV, Suresh Kumar N, Madhusudhana Chetty C. Analgesic, anti-pyretic and anti-inflammatory activity of dietary sesame oil in Experimental Animal Models. *Pharmacologia*, 2011; 2(6): 172-177.
36. Pathak N., Rai A.K., Kumari R., Bhat K.V. Value addition in sesame: a perspective on bioactive components for enhancing utility and profitability. *Pharmacogn Rev*, 2014; 8(16): 147-155.
37. Mullany L.C., Darmstadt G.L. Khatry S.K., Tielsch J.M. Traditional Massage of Newborns in Nepal: Implications for Trials of Improved Practice. *J Trop Pediatr*, 2005; 51(2): 82-86.
38. Darmstadt G.L., Mao-Qiang M., Chi E., Saha S.K., Ziboh V.A., Black R.E., Santosham M., Elias P.M. Impact of topical oils on the skin barrier: possible implications for neonatal health in developing countries. *Acta Paediatr*, 2002; 91: 546-554.
39. Danby S.G., AlEnezi A.I., Sultan A., Lavender T., Chittock J., Brown K., Cork M.J. Effect of Olive and Sunflower Seed Oil on the Adult Skin Barrier: Implications for Neonatal Skin Care. *Pediatr Dermatol*, 2013; 30(1): 42-50.
40. Hassenain M.M.M., Abedel-Razek A.G. Chromatographic Quantitation of Some Bioactive Minor Components in Oils of Wheat Germ and Grape Seeds Produced as By-Products. *J Oleo Sci*, 2009; 58(5): 227-233.
41. Sabikhi L., Kumar M.H.S. Fatty Acid Profile of Unconventional Oil seeds. *Adv Food Nutr Res*, 2012; 67: 141-184.
42. Taheri P.A., Goudarzi Z., Shariat M., Nariman S., Matin E.N. The effect of a short course of moderate pressure sunflower oil massage on the weight gain velocity and length of NICU stay in preterm infants. *Infant Behav Dev*, 2018; 50: 22-27.
43. Ahmed A.S.M.N.U., Saha S.K., Chowdhury M.A.K.A., Law P.A., Black R.E., Santosham M., Darmstadt G.L. Acceptability of Massage with Skin Barrier-enhancing Emollients in Young Neonates in Bangladesh. *J Health Popul Nutr*, 2007; 25(2): 236-240.
44. Al-Obaidi J.R., Halabi M.F., al. Khalifah N.S., Asanar S., Al-Soqeer A.A., Attia M.F. A review on plant importance, biotechnological aspects, and cultivation challenges of jojoba plant. *Biol Res*, 2017; 50(1):25. doi: 10.1186/s40659-017-0131-x.
45. Miklaszewska M., Banaś A. Biochemical characterization and substrate specificity of jojoba fatty acyl-CoA reductase and jojoba wax synthase. *Plant Sci*, 2016; 249: 84-92.
46. Al-Qizwini H., Ekbal A.K., Mhaidat N.M., Maraqa A. Antioxidant and antimicrobial activities of jordanian *Simmondsia chinensis* (link) ck schneid. *Eur Sci J*. 2014;10: 229-41.
47. Huang Z.-R., Lin Y.-K., Fang J.-Y. Biological and Pharmacological Activities of Squalene and Related Compounds: Potential Uses in Cosmetic Dermatology. *Molecules*, 2009; 14: 540-554.
48. Kacalak-Rzepka A., Bielecka-Grzela S., Klimowicz A., Wesołowska J., Maleszka R. Skóra sucha jako problem dermatologiczny i kosmetyczny. *Ann Acad Med Stetin*, 2008; 54(3): 54-57.
49. Pazyar N., Yaghoobi R., Ghassemi M.R., Kazerouni A., Rafeie E., Jamshyadian N. Jojoba in dermatology: a succinct review. *G Ital Dermatol Venereol*, 2013;148(6): 687-691.
50. Patzelt A., Lademann J., Richter H., Darvin M.E., Schanzer S., Thiede G., Sterry W., Vergou T. Hauser M. In vivo investigations on the penetration of various oils and their influence on the skin barrier. *Skin Res Technol*, 2012; 18: 364-369.
51. Habashy R.R., Abdel-Naim A.B., Khalifa A.E., Al-Azizi M.M. Anti-inflammatory effects of jojoba liquid wax in experimental models. *Pharmacol Res*, 2005; 51(2): 95-105.
52. Ranzato E., Martinotti S., Burlando B. Wound healing properties of jojoba liquid wax: an in vitro study. *J Ethnopharmacol*, 2011; 134(2): 443-439.
53. Yada S., Lapsley K., Huang G. A review of composition studies of cultivated almonds: Macronutrients and micronutrients. *J Food Compos Anal*, 2011; 24: 469-480.
54. Ruggeri S., Cappelloni M., Gambelli L., Nicoli S., Carnovale E. Chemical composition and nutritive

- value of nuts grown in Italy. *Ital J Food Sci*, 1998; 3(10): 243-251.
55. Maguire L.S., O'Sullivan M., Galvin K., O'Connor T.P., O'Brien N.M. Fatty acid profile, tocopherol, squalene and phytosterol content of walnuts, peanuts, hazelnuts and the macadamia nut. *Int J Food Sci Nutr*, 2004; 55:171-178.
 56. López-Uriarte P., Bulló M., Casas-Agustench P., Babio N., Salas-Salvadó J. Nuts and oxidation: a systematic review. *Nutr Rev*, 2009; 67: 497-508.
 57. Chang S.K., Alasalvar C., Bolling B.W, Shahidi F. Nuts and their co-products: The impact of processing (roasting) on phenolics, bioavailability, and health benefits-A comprehensive review. *J Funct Food*, 2016; 6: 88-122.
 58. Kornsteiner M., Wagner K.-H., Elmadfa I. Analytical, Nutritional and Clinical Methods. Tocopherols and total phenolics in 10 different nut types. *Food Chem*, 2006; 98: 381-387.
 59. Mandalari G., Faulks R.M., Bisignano C., Waldron K.W., Narbad A., Wickham M.S.J. *In vitro* evaluation of the prebiotic properties of almond skins (*Amygdalus communis* L.). *FEMS Microbiol Lett*, 2010, 304(2): 116-122.
 60. Stamatas G.N., de Sterke J., Hauser M., von Stetten O., van der Pol A. *Lipid uptake and skin occlusion following topical application of oils on adult and infant skin*. *J Dermatol Sci*, 2008; 50(2): 135-142.
 61. Gumus Z.P., Guler E., Demir B., Barlas F.B., Yavuz M., Colpankan D., Senisik A.M., Teksoz S., Unak P., Coskunol H., Timur S. Herbal infusions of black seed and wheat germ oil: Their chemical profiles, in vitro bio-investigations and effective formulations as Phyto-Nanoemulsions. *Colloids and Surfaces B: Biointerfaces*, 2015;133: 73-80.
 62. Dunford N.T., Zhang M.Q. Pressurized solvent extraction of wheat germ oil. *Food Res Int*, 2003; 36: 905-909.
 63. Piras A., Rosa A., Falconieri D., Silvia Porcedda S. Dessì M.A., Marongiu B. Extraction of Oil from Wheat Germ by Supercritical CO₂. *Molecules*, 2009; 14: 2573-2581.
 64. Nayak B.S, Ramdath D.D., Marshall J.R., Isitor G., Xue S., Shi J. Wound-healing Properties of the Oils of *Vitis vinifera* and *Vaccinium macrocarpon*. *Phytother Res*, 2011; 25: 1201-1208.
 65. Mezzomo N., Mileo B.R., Friedrich M.T., Martínez J., Sandra R.S.Ferreira S.R.S. Supercritical fluid extraction of peach (*Prunus persica*) almond oil: Process yield and extract composition. *Bioresource Technol*, 2010; 101(14): 5622-5632.
 66. Pereira T.A., Guerreiro C.M., Maruno M., Ferrari M., Rocha-Filho P.A. Exotic Vegetable Oils for Cosmetic O/W Nanoemulsions: In Vivo Evaluation. *Molecules*, 2016; 21, 248, doi:10.3390/molecules 21030248.
 67. Ejindu A. The effects of foot and facial massage on sleep induction, blood pressure, pulse and respiratory rate: Crossover pilot study. *Complement Ther Clin Pract*, 2007; 13: 266-275.

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