TRADITION AND MODERNITY IN VETERINARY MEDICINE, 2017, vol. 2, No 1(2): 25–30

OLEUM OREGANO – PROPERTIES AND APPLICATION

Ralitsa Bankova

University of Forestry, Faculty of Veterinary Medicine, Sofia, Bulgaria
E-mail: drr_bankova@abv.bg

ABSTRACT

The tendency seems to be search of natural and ecological products for application in the veterinary medicine. Biological active substances of plant origin are such group. One of the example is oregano essential oil. It has an application in veterinary medicine. It essential compounds are: timol, carvacrol, γ-terpinen, p-cimen, terpineol, trans-sabinen-hydratum. A number of properties have been proven antimicrobial, antifungal, nutritional, antioxidant, spasmolytic, cytostatic, antiparasitic and antihepatotoxic of oregano essential oil. The aim of this reviw is to present new data about its theraupeutic application.

Key words: oregano essential oil, compounds, properties, new data, application.

Introduction

The application of oregano oil started in Ancient Greece. In Greek the word oregano is translated as joy of the mountains". The Greeks were first to use oil for medicinal purposes, such as a powerful antiviral, antibacterial, antiseptic, antifungal agent and also as a remedy for pain, and inflammation. It was the main antibacterial tool used by Hippocrates. Oregano leaves were traditionally used to treat illnesses related to the respiratory and digestive systems. The plant was also used in Roman medicine and cuisine - probably the Romans started to cultivate. It hence spice spreads across Central and Northern Europe, and after the discovery of the New World (America).

Antimicrobial and Antifungal Activities

The three essential oils (Origanum vulgare, Origanum dictamnus and commercially available oregano oil) exhibited high levels of antimicrobial activity against eight strains of Gram-positive and Gram-negative bacteria (Escherichia coli, Pseudomonas aeruginosa, Salmonella typhimurium, Staphylococcus aureus, Rhizobium leguminosarum, Bacillus subtilis). The essential oil of O. vulgare was extremely bactericidal at 1/4000 dilution and even at dilutions as high as 1/50000 caused considerable decrease in bacterial growth rates. The same essential oil also exhibited high levels of cytotoxicity against four permanent cell lines including Vero, Hep-2, RSC and HeLa (two derived from human cancers) [27].

In study were used the essential oils of oregano, thyme and wild thyme. The antibacterial activity of the essential oils was tested by disc diffusion method and by broth micro-dilution susceptibility assay. The strongest antibacterial effect was shown by oregano essential oil (OEO) against Escherichia coli, Salmonella cholerae suis, Proteus mirabilis, Staphylococcus aureus and Enterococcus faecalis. Minimal inhibitory concentration (MIC) of OEO was 0.39 μl/ml by Gram-negative bacteria and 0.7839 μl/ml in Gram-positive bacteria respectively [16].

In vitro activity of the oregano essential oil against sixteen Candida species isolates has been established. Ten standard strains C. albicans tested. Six Candida albicans isolates from the animal mucous membranes (from dogs and monkey) were tested in parallel. C. albicans isolates obtained from animal mucous membranes exhibited MIC and minimal fungicidal concentration (MFC) values

of 2.72 μl/ml and 5 μl/ml respectively. MIC and MFC values for C. albicans standard strains were 2.97 μl/ml and 3.54 μl/ml respectively [7].

The antifungal activity of oregano essential oil against some species of Aspergillus has been established. At concentration 1000 ppm., OEO completely inhibited the fungal growth by Aspergillus ochraceus NRRL 3174 and ochratoxin A production up to 21 degrees C. At 750 ppm, OEO was completely effective up to 14 degrees C [4].

Growth Promoter

In experiment 160 twenty-one-day old pigs were divided to four groups: 1. basal diet (control group) and 2. 3. and 4. group with the basal diet supplemented with 0.5, 1.0, or 1.5 kg per tonne OEO. Pigs fed OEO at 1.5 kg per tonne achieved the highest average daily gain (ADG). This result proves the growth promoter effect of oregano essential oil [1].

In study sows were given diets containing 1000 ppm oregano in the prefarrowing. Oregano-treated groups showed a lower annual sow mortality rate, a lower sow culling rate during lactation, an increased subsequent farrowing rate, and more live-born piglets per litter compared with the non-treated sows. The conclusion was that dietary oregano supplementation improved reproductive performance of sows [2].

Two hundred day-old broilers were divided into four groups: LM – control group without additive, L1, L2 and L3 – 0.3 %, 0,7 % and 1 % oregano oil groups respectively. The highest weight gain was observed on the L3 (2484 g). The addition of 1% oregano oil to the diet improved feed conversion ratio by approximatley 5 % compared to the control group. In conclusion the results show that essential oil of Origanum vulgare could be considered a potential natural growth promoter in poultry [13].

Antiinflammatory and Antioxidant Activities

In the study in vitro was established that carvacrol inhibites production of prostaglandin E2 catalysed by COX-2. The results of the study demonstrate possible antiinflammatory potential of carvacrol [18].

In experiment oregano essential oil, administered in the diet (0.05 %–2.0 %) had a significant protective effect in rodents against chemically induced colonic damage, inflammatory cell infiltration, and vascular dilation along with suppressing production of proinflammatory cytokines IL-1β and IL-6 [26].

The oral administration of oregano extract significantly prevented mouse gastritis induced by cold-restraint stress test. Percutaneous administration of oregano extract also significantly prevented mouse contact hypersensitivity induced by oxazolone. This study demonstrated antiinflammatory and antioxidant activities of oregano extract [32].

The study of the turkeys meat were fed (4 weeks) with 200 mg oregano essential oil the content of malonic aldehyde had the lowest. Thus, it is proven that a diet with OEO can delay the deterioration induced by lipid oxidation. These results prove that the OEO can be used to replace synthetic antioxidants in the food industry or other areas [3].

In experiment the property of OEO to inhibit the generation of malonic aldehyde in the first stage of lipid oxidation is determined by TBA test (thiobarbituric acid test) method. In a concentration of 640–800 mg/l the OEO shows a protective antioxidative activity, which is superior to the

standard substances butylated hydroxyanisole (BHA-synthetic antioxidative substans) and α-tocopherol but equal to butylated hydroxytoluene (BHT). When the amount of the OEO is increased to 1000 mg/l, the antioxidative capacity is better than that of BHT [3].

Antiparasitic Action

A dietary supplementation of oregano essential oil (300 mg/kg) showed a positive effect on the performance of broiler chickens experimentally infected with Eimeria tenella. Throughout the experimental period of 42 days, OEO exerted an anticoccidial effect against Eimeria tenella, which was, however, lower than that exhibited by lasalocid [3].

The hydroalcoholic extract (80 mg/ml) of Origanum vulgare in vitro inhibits on gastrointestinal nematode eggs of cattle. It has ovicidal potencial on gastrointestinal nematodes of cattle [10].

Pensel et all., 2014 suggest that essential oil of O. vulgare have anthelmintic effect against protoscoleces and cysts of Echinococcus granulosus [23].

Essential oil of Origanum onites was found to be effective against the tick Rhipicephalus turanicus. 25 % and higher concentrations of the oil were effective in killing the ticks by the 24-h posttreatment. Lethal concentrations for 50 % (LC (50)) and 90 % (LC (90)) of 2.34 % and 7.12 %, respectively, were detected 24 h post-treatment. These findings indicate that the essential oil of O. onites has potential to be utilized at reasonable concentrations to control tick infestations [6, 8]. Parasites, such as head lice and scabies, as well as internal parasites, are repelled by oregano oil. The oil can be added to soaps, shampoos, and diluted in olive oil for topical applications [3].

Effects on Immunity

It has investigated the effect of an aqueous extract of Origanum vulgare on lipid peroxidation and anti-oxidant status in 1,2-dimethylhydrazine (DMH) - induced rat colon carcinogenesis. The levels of the antioxidants were decreased in DMH - treated rats, but were significantly reversed on oregano supplementation (40 mg/kg). Oregano supplementation had a modulatory role on tissue lipid peroxidation and antioxidant profile in colon cancer-bearing rats, which suggested a possible anticancer property of oregano [28].

In this study, the antiproliferative activity of plant extracts from Origanum majorana was tested on human lymphoblastic leukemia cell line Jurkat. Marjoram extracts had an IC50 of approximately 8 and 5 mg/ml in Jurkat cells at 48 and 96 h respectively with a significant decrease in viability of 78 % at 48 h and 67 % at 96 h as compared to the control. Marjoram significantly reduced proliferation of Jurkat cells at non-cytotoxic concentrations ranging from 0.25 to 2 mg/ml with inhibitory percentage of 53–90 % respectively at day 2. The conclusions from this study suggest that marjoram extracts can stimulate apoptosis. It has antiproliferative effect and high antioxidant activity [1].

The cytotoxic effect of methanolic extract from Origanum vulgare was examined on HCT-116 cell line in vitro in dosis 500 μg/ml only 10 % of the cells remain viable. Only the concentration of the plant extract (250 μg/ml) killed 67 % of the cells (33 % of viable cells) in the treatment of MDA-MB-231 cell lines after 72 h [14].

It has investigated the effects of carvacrol, obtained of Origanum onites essential oil, on DNA synthesis of N-ras transformed myoblast cells. Incubation of the cells with different doses of carvacrol prevented DNA synthesis in the growth medium and ras-activating medium, which contains

dexamethasone. This result suggesting the possibility that carvacrol may find application in cancer therapy [30].

In experiment Mexican oregano oil and its main component, carvacrol, are able to inhibit different human and animal viruses in vitro. Specifically, the antiviral effects of Mexican oregano oil on acyclovir-resistant herpes simplex virus type 1 (ACVR-HHV-1) and human respiratory syncytial virus (HRSV) and of carvacrol on human rotavirus (RV) [24].

Systemic Effects

In the study a water extract of Origanum vulgare administered orally at 20 mg/kg demonstrated antihyperglycemic activity, improved the reduction in serum insulin, liver and muscle glycogen contents and body weight in streptozocin (STZ) diabetic rats. That, s why the oregano could be find a application in the diabetes therapy [21].

A water extract of oregano had the highest alpha-glucosidase inhibition activity (93.7%) correlated to the phenolic content. Kwon et all. 2006 also investigated the ability of the plant extracts to inhibit rabbit lung angiotensin I-converting enzyme (ACE). The water extracts of oregano had the ACE inhibitory activity oregano (37.4 %) [17].

O. majorana ethanolic extract treatment in dose 500 mg/kg for 14 days against cisplatin-induced dyslipidemia in rats declines the levels of total lipid, triglycerides, and LDL-cholesterol and increase the HDL-cholesterol level significantly. It has positive hypolipidemic potential of oregano extract [9].

The dietary supplementation with thymol and carvacrol (1 mmol/kg diet) suppressed serum cholesterol levels, which in part could be due to increased activity of geranyl pyrophosphate pyrophosphatase in cockerels [5].

In study forty five adult male albino rats were classified into three main groups as follows: group I: control. Group II: hypertension was induced by ligation of left renal artery. Group III: hypertension was induced and given Oregano vulgare (OV) as 100 mg/kg body weight daily for eight weeks. Significant increase in creatinine and cholesterol in untreated in contrast to other groups. The hypertension group induced myocardial abnormalities as disruption, vacuolation, inflammation and wide separation of cardiac muscle fibers. Myocyte apoptosis were significantly decreased with oregano compared with other groups. The supplementation of OV herbetic extract (flavonoid) in hypertensive rats partially prevented such occurred changes, suggesting its possible protective effect against the risk of the progression of cardiovascular diseases during hypertension [12].

In the study aqueous and alcoholic extracts of Oregano majorana induced a significant decrease in serum activities of transaminases (AST, ALT), ALP, urea and creatinine and improved the liver and kidney histology in lead acetate treated toxicity in mice. Mice were treated with the 3 different forms of Oregano majorana, one month before and maintained with lead acetate administration. It could be concluded that Oregano majorana plays an important role in ameliorating liver and kidney functions and genotoxicity induced by lead toxicity. There are potential hepatoprotective and nephroprotective effect [11].

Single doses of Oregano vulgare (OV) extract (50, 100 and 200 m/kg) were administered intraperitoneally in male rats. OV extract (200 mg/kg) increased percent of time spent on open arms and open arms entries, compared with control group. In addition, the extract decreased locomotor activity in the open field test. Conclusion: These results suggest that the aqueous extract of OV has anxiolytic effect and may also have potential sedative effects [22].

Carvacrol, administered for seven consecutive days (12.5 mg/kg p.o.) was able to increase dopamine and serotonin levels in the prefrontal cortex and hippocampus [31].

Conclusions

In experiments it was found that oregano and its components exhibit antimicrobial, antifungal, antioxidant, anticoccidials, anthelmintic, acaricidal and insecticidal effects which determine their use in veterinary medicine. The other listed experimentally identified potentials are not proven effects of oregano and its essential oil. They will be a subject to further investigations.

References

1. Abdel-Massih, R., R. Fares, S. Bazzi, N. El-Chami, E. Baydoun. (2010). *The apoptotic and anti-proliferative activity of Origanum majorana extracts on human leukemic cell line*. Leukemia research. August 2010, Volume 34, Issue 8: 1052–1056.
2. Amrik, B., G. Bilkei. (2004). *Influence of farm application of oregano on performances of sows*. Veterinary Journal. 2004 Aug; 45(8): 674–677.
3. Baser C., G. (2010). *Buchbauer, Biological activities of essential oils. Handbook of essential oils*. Science, Technology and Application, 2010, pp. 44; 266. 884, 2248.
4. Basílico M. Z., Basílico J. C. (1999). *Inhibitory effects of some spice essential oils on Aspergillus ochraceus NRRL 3174 growth and ochratoxin A production*. Appl. Microbiol. 1999 Oct; 29(4): 238–241.
5. Case G. L., He L., Mo H., Elson C. E. (1995). *Induction of geranyl pyrophosphate pyrophosphatase activity by cholesterol-suppressive isoprenoids*. Lipids. 1995 Apr., 30(4): 357–359.
6. Cetin, H., J. Cilek, L. Aydin, A. Yanikoglu. (2009). *Acaricidal effects of the essential oil of Origanum minutiflorum (Lamiaceae) against Rhipicephalus turanicus (Acari: Ixodidae)*. Veterinary parasitology, Volume 160, Issues 3–4, 23 March 2009: 359–361.
7. Cleff, M., A. Meinerz, M. Xavier, L. Schuch, M. Meireles; M., Rodrigues, J. Braga de Mello. (2010). *In vitro activity of Origanum vulgare essential oil against candida species*. Brazilian Journal of microbiology (2010) 41: 116–123.
8. Coskun, S., O. Girisgin, M. Kürkcüoglu, H. Malyer, A. Girisgin, N. Kırımer, K. Baser. (2008). *Acaricidal efficacy of Origanum onites L. essential oil against Rhipicephalus turanicus (Ixodidae)*. Parasitology research, July 2008, Volume 103, Issue 2: 259–261.
9. Desouky, S., M. Marzouk, A. Soliman, A. Sayed. (2015). *Modulatory effect of Origanum majorana extract against cisplatin-induced dyslipidemia in rats*. International Journal of current research in life sciences. Vol. 4, No. 6, June, 2015, 228–234.
10. Dias de Castro, L., I. Madrid, C. Guidotti, L. de Castro, M. Cleff, M. Berne, F. Leite. (2013). *Origanum vulgare (Lamiaceae) ovicidal potential on castrointestinal nematodes of cattle*. Ciência. animal. brasileira. vol. 14 No 4 Goiânia Oct./Dec. 2013.
11. El-Ashmawy, I., A. El-Nahas, O. Salama. (2005). *Protective effect of volatile oil, alcoholic and aqueous extracts of Origanum majorana on lead acetate toxicity in mice*. Basic & clinical pharmacology & toxicology. Volume 97, Issue 4, October 2005: 238–243.
12. Faruk, E., A. Naser, E. Ebrahim, R. Ebrahim. *Histological, immunohistochemical and biochemical study on the possible cardioprotective and antihypertensive role of the flavonoid in unilateral renal artery ligation of adult albino rats*. Cytology & Histology, Volume 6, Issue 3, p. 1036.
13. Fotea, L., E. Costachescu, G. Hoha, G., D. Leonte. (2011). *The effect of oregano essential oil (Origanum vulgare L.) on broiler performance*. Food and agriculture organization, 2011, 253–256.
14. Grbović, F., Stanković, M., M. Curcic, N. Dordevic, D. Šeklić, M. Topuzović, S. Marković. (2013). *In vitro cytotoxic activity of Origanum vulgare L. on HCT-116 and MDA-MB-231 cell lines*. Plants

2013, 2(3): 371–378.

15. Hassan, M., G. Moghaddam, I. Ansari, M. Roghani, M. Moradi. (2013). *The effects of Origanum majorana on oxidative stress and histopathology of renal tissue among streptozotocin-induced diabetic rats*. Thrita Journal of medical sciences. 2013 September; 2(3): 29–34.
16. Jovanka, L., I. Čabarkapa, G., Todorovic, S., Pavkov, S., Sredanovic, T., Coghill-Galonja, K. Ljiljana. (2011). *In vitro antibacterial activity of essential oils from plant family Lamiaceae*. Romanian biotechnological letters Vol. 16, No. 2, 2011: 6034–6041.
17. Kwon, Y., D. Vattem, K. Shetty. (2006). *Evaluation of clonal herbs of Lamiaceae species for management of diabetes and hypertension*. Asia Pac. J. Clin. Nutr. 2006; 15 (1): 107–118.
18. Landa, P., L. Kokoska, M. Pribylova, T. Vanek, P. Marsik. (2009). *In vitro anti-inflammatory activity of carvacrol: Inhibitory effect on COX-2 catalyzed prostaglandin E (2) biosynthesis*. Arch Pharm Res. 2009 Jan; 32(1): 75–78.
19. Lermioglu F, S. Bagci, S. Onderoglu, R. Ortac, L. Tugrul. (1997). *Evaluation of the long-term effects of oleum origani on the toxicity induced by administration of streptozotocin in rats*. J. Pharm. Pharmacol. 1997 Nov;49(11): 1157–61.
20. Moghaddam, M., I. Ansari, M. Roghani, M. Moradi. (2013). *The effects of Origanum majorana on oxidative stress and histopathology of renal tissue among streptozotocin-induced diabetic rats*. Thrita Journal of medical sciences. 2013 September; 2(3), 29–34.
21. Mohamed, N., O. Nassier. (2013). *The antihyperglycaemic effect of the aqueous extract of Origanium vulgare leaves in streptozotocin-induced diabetic rats*. Jordan Journal of biological sciences. Volume 6, Number 1, March .2013: 31–38.
22. Mombeini, T., S. Mazloumi, J. Shams. (2015). *Elevated plus-maze and open field tests in the rat*. Journal of basic and clinical pathophysiology. Volume 3, Number 2, Spring – Summer 2015: 49–57.
23. Pensel, P., M. Maggiore, L. Gende, M. Eguaras, M. Denegri, M. Elissondo. (2014). *Efficacy of essential oils of Thymus vulgaris and Origanum vulgare on Echinococcus granulosus*. Interdisciplinary perspectives on infectious diseases. Volume 2014, p. 12.
24. Pilau, M., S. Alves, R. Weiblen, S. Arenhart, A. Cueto, L. Lovato. (2011). *Antiviral activity of the Lippia graveolens (Mexican oregano) essential oil and its main compound carvacrol against human and animal viruses*. Braz. J. Microbiol. vol.42 No.4 São Paulo Oct./Dec. 2011: 1616–1624.
25. Ragland, D., J. Schneider, D. Stevenson, M. Hill, M. Bakker. (2007). *Oregano oil as an alternative to antimicrobials in nursery diets*. Journal of swine health and production – November and December 2007: 346–350.
26. Singletary K., Oregano. (2010). *Overview of the literature on health benefits*. Nutrition today, Volume 45 Number 3 May/June, 2010: 129–138.
27. Sivropoulou, A., E. Papanikolaou, C. Nikolaou, St. Kokkini, T. Lanaras, M. Arsenakis. (1996). *Antimicrobial and cytotoxic activities of Origanum essential oils*. J. Agric. Food Chem. 1996, 44: 1202–1205.
28. Srihari T, M. Sengottuvelan, N. Nalini. (2008). *Dose-dependent effect of oregano (Origanum vulgare L.) on lipid peroxidation and antioxidant status in 1, 2-dimethylhydrazine-induced rat colon carcinogenesis*. J. Pharm. Pharmacol. 2008 Jun;60 (6): 787–794.
29. Stelter K, J. Frahm, J. Paulsen, A. Berk, M. Kleinwächter, D. Selmar, S. Dänicke. (2013). *Effects of oregano on performance and immunmodulating factors in weaned piglets*. Arch. Anim. Nutr. 2013 Dec; 67 (6): 461–476.
30. Zeytinoglu H., Z. Incesu, K. H. Baser. (2003). *Inhibition of DNA synthesis by carvacrol in mouse myoblast cells bearing a human N-RAS oncogene*. Phytomedicine. 2003 May;10(4): 292–299.
31. Zotti, M. M. Colaianna, M. Morgese, P. Tucci, S. Schiavone, P. Avato, L. Trabace. (2013). *Carvacrol: from ancient flavoring to neuromodulatory agent*. Molecules 2013, 18: 6161–6172.
32. Yoshino, K., N. Higashi, K. Koga. (2006). *Antioxidant and antiinflammatory activities of Oregano extract*. Journal of Health Science, 2006, 52 (2): 169–173.