

THE PLANT

ROSEMARY: Antioxidant and health benefits

Rosemary (*Rosmarinus officinalis* L.) is a sub-shrub of the *Lamiaceae* family, endogenous to the Mediterranean coast (Europe, Asia and Africa).

It is well known that the plant secondary metabolite production is intrinsically dependent to environmental conditions, and changes continuously in response to these conditions (biotic stress, climate, fertilizers...) as it constitutes a signal to other plants (warning), pollinators (attraction), herbivorous insects (repellent), or predators to the latter (attraction). This ability for an individual to modify its metabolic content establishes its ability to survive. The secondary metabolite content also differs between the various parts of the plant (roots, stem, leaves, flower) according to its role and to the vegetative cycle [1]. The antioxidant, antifungal, antibacterial but also anti-inflammatory activities of rosemary extracts have been reported [2]. These activities are linked to a wide chemistry and an abundant polyphenol content of rosemary plants: carnosic acid, carnosol, 12-O-methylcarnosic acid (phenolic diterpenes), rosmarinic acid (caffeoyl compound), genkwanin and

isoscuteallarein 7-O-glucoside (flavones). For example, the extracts with the higher content in rosmarinic acid and isoscuteallarein 7-O-glucoside demonstrate the strongest antioxidant activity. *In vitro* studies evidence the antimicrobial effect of rosemary essential oil (EO), with low MIC (<10µL/mL), on *Escherichia coli*, *Salmonella* sp., *Listeria innocua*, *Staphylococcus aureus*, *Clostridium perfringens*, *Aeromonas hydrophila*, *Bacillus cereus*.

In broilers, the supplementation of basal diet with rosemary EO appears to improve body weight gain at the same level than antibiotics used as growth promoter do [3]. A supplementation with rosemary EO or leaves (0.5%) stabilizes intestine microbiota and health, and has been shown to improve intestinal vili size and crypt depth. As it decreases the number and diversity of bacteria, it could reduce at the same time growth-depressing bacterial metabolites and competition for nutrient use in the gut, and also lead to a potent selection of healthier bacterial communities. In pigs fed with rosemary extract supplementation (1g/kg diet), PUFA/SFA ratio (polyunsaturated/saturated fatty acids) in muscle and lard was significantly higher compared to the control group, suggesting a possible antioxidative activity of the extract *in vivo*.



Rosemary extracts have antioxidant, antifungal, antibacterial but also anti-inflammatory activities ©Kreastyl

[1] Del Baño, M. J., Lorente, J., Castillo, J., Benavente-García, O., del Río, J. A., Ortuño, A., ... & Gerard, D. (2003). Phenolic diterpenes, flavones, and rosmarinic acid distribution during the development of leaves, flowers, stems, and roots of *Rosmarinus officinalis*. Antioxidant activity. *Journal of agricultural and food chemistry*, 51(15), 4247-4253.

[2] Zaouali, Y., Bouzaine, T., & Boussaid, M. (2010). Essential oils composition in two *Rosmarinus officinalis* L. varieties and incidence for antimicrobial and antioxidant activities. *Food and Chemical Toxicology*, 48(11), 3144-3152.

[3] Mathlouthi, N., Bouzaienne, T., Oueslati, I., Recoquilly, F., Hamdi, M., Urdaci, M., & Bergaoui, R. (2012). Use of rosemary, oregano, and a commercial blend of essential oils in broiler chickens: *in vitro* antimicrobial activities and effects on growth performance. *Journal of Animal Science*, 90(3), 813-823.

World of botanicals

Essential oils and fish meat quality

Fish is a high perishable food as fish muscle is susceptible to protein and lipid oxidation during frozen storage. In this study, dietary inclusion of a mixture of carvacrol, eucalyptol and thymol improved the protection of rainbow trout's fillets during frozen storage at -10°C during 6 months. Carbonylation of specific myofibrillar and sarcoplasmic proteins as well as lipid oxidation and rancidity were decreased by the essential oils. These results show that it is possible to improve fish quality by including essential oils in the feed.

Santos et al., *Animal*, 2019.

Thymol and broiler antioxidative defence

Antioxidative defences play two main roles in animal: improved antioxidative status to fight against stress, and better product (meat, egg, ...) quality. Following thymol essential oil introduction in broiler feed, plasma thymol concentration significantly increased and plasma superoxide dismutase activity was enhanced; malondialdehyde concentration significantly decreased in plasma but only a trend was observed in breast muscle where the level of thymol was probably too low.

Placha et al., *British Poultry Science*, 2019.

INTERVIEW

Marie-Geneviève Dijoux-Franca "MDR*, an urgent issue"

Director of the Center for the Study of Natural Substances (CESN) in the Laboratory of Microbial Ecology (LEM), UMR5557 of CNRS and University Claude Bernard-Lyon 1, Marie-Geneviève Dijoux-Franca was the guest of ID4FEED during the seminar organized by Altilis-Ajinomoto the 10th of September in Rennes (France).



Marie-Geneviève Dijoux-Franca

Biosis: What are the activities of your research laboratory?

Marie-Geneviève Dijoux-Franca:

The LEM's research deals with Microbial Ecology, a discipline at the crossroads of two major research fields: ecology and microbiology. It aims to better understanding the physiology of microorganisms, their interactions with other organisms and with the environment in general. Symmetrically, it is of interest to clarify the impact of biotic and abiotic factors of the environment, from the individual to the community in an ecosystem.

BIOSIS: Why is MDR a hot topic?

M-G.D-F: Countries all over the world and all environments (water, soil, livestock and wild animals, food, etc.) are concerned by MDR whose challenge was initiated by the United Nations General Assembly in September 2018. It is therefore urgent to identify reservoirs and factors favoring the emergence and dispersion of resistance to antimicrobials. It is a real threat because the first cases of Gram-negative bacteria resistant to colistin, the only antibiotic still active against enterobacteria until 2018, appeared in 2019.

Biosis : Where is the research on the understanding of MDR mechanisms ?

M-G.D-F: Diverse resistance mechanisms have been described now. But efflux pumps, which are membrane transporters both in eucaryotes and procaryotes cells, involved in detoxification mechanisms, contribute to cross MDR. There are different types of efflux

pumps and some are Gram-negative specific and have very different substrates (antibiotics, heavy metals, solvents, etc). It is a great concern to understand what are the factors conditioning their expression and dispersion in environment as their link to environmental multi-resistance.

Biosis: What is the interest of natural substances in the reversion of this MDR?

M-G.D-F: Plants and pollutants i.e. heavy metals have an impact on microbial diversity as well as on MDR expression. This has been shown by experiments conducted on three types of soils: mining soils in Vietnam, agricultural soils in France and Burkina Faso and urban soils in France. Plants and microorganisms adapt themselves to polluted environments through defenses mechanisms: changes in chemical composition in the plant, and overexpression of efflux pumps in microorganisms. Hence, it was shown changes on microbial diversity (phylogeny) in soils and more specifically an increase of microorganisms with resistant phenotype. Moreover, secondary metabolites from many plants exhibit effects on MDR and efflux pumps. These natural compounds, described as efflux pump inhibitors (EPI) restoring therefore the sensitivity to antibiotics, have a very important potential in animal nutrition. The research on the efficacy of these EPI is part of the collaboration between the CESN and ID4FEED.

* MDR : Multidrug bacterian resistance

Global

A new sensory analysis laboratory

On Monday November 25th, ID4FEED organized a first event for the set-up of its sensory analysis lab in Valréas (Provence region, France). After an introduction of Dr. Caroline Reverdy, specialist in sensory evaluation and education applied to the senses of taste, olfaction and vision, the future panelists did some first exercises of flavor analysis in pig and poultry feeds. A useful tool that will help ID4FEED to strengthen the quality of its flavors and flavors range products (ID FLASH range).

ID PHYT CAPCIN* trial in Thailand

On a trial made on 44 cross bred sows with a control and a group receiving Capcin in late gestation at 1.4 g/sow/day, Capcin supplementation improved sow feed intake (+180 g/d) and milk production (+7.5 %) during the lactation period, significantly decreased body fat loss (-30 %) and body weight loss (-26 %) at weaning. The weaning-to-estrus interval was also significantly decreased (-0.7 day). Capcin also improved litter weight (+6.2 kg at weaning), piglet body weight (270 g) and uniformity (+2 %), and reduced mortality & culled (-25 %).

*a vectorized chili pepper powder enriched in capsaicinoids, the antioxidant and anti-inflammatory active compounds, thanks to a patented technology.



DIARY

Atlanta (USA)
IPPE International Production & Processing Expo

28-30
Jan.

Anney (France)
Biosis Days

12-13
May

Geneva (Switzerland)
Vitafoods Europe

12-14
May