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The effect of clove essential oil in the microbiological, physical and sensorial properties of pig meat

Ana Galveias[1], Maria Inês Rouxinol[2], Sara Ricardo-Rodrigues[2], Marta Laranjo[2], Ana Cristina Agulheiro Santos[2,3], Maria Eduarda Potes[2,4], Patrícia Capelo Soares[2,5], Miguel Elias[2,3] *

1- *Instituto de Ciências da Terra, Col. Luís António Verney, Rua Romão Ramalho, 59, 7002-554, Évora, Portugal*
2- *MED & CHANGE Institute for Advanced Studies and Research, Universidade de Évora, Ap. 94, 7006-554 Évora, Portugal*
3- *Dep Fitotecnia, Escola de Ciências e Tecnologia, Universidade de Évora, Ap. 94, 7006-554, Évora, Portugal*
4- *Dep Medicina Veterinária, Escola de Ciências e Tecnologia, Universidade de Évora, Ap. 94, 7006-554, Évora, Portugal*
5- *Q-Staff-Parque do Alentejo de Ciência e Tecnologia, R Luis Adelino Fonseca, L1, 7005-841, Évora, Portugal*
* elias@uevora.pt

Essential oils (EO) are extracted from aromatc plant material through steam distillation and the fragrant substances are volatile under normal conditions. Many of the EO can be used for food products preservation in a safe, environmentally friendly and convenient way that satisfies today's consumer preferences. It is known that the most significant causes of meat spoilage are oxidative processes and the action of spoilage microrganisms. EO exhibit antibacterial and antifungal activity and so are effective against foodborne bacteria as is shown by in vitro evaluations [1]. The EO of thyme, oregano and clove, have been investigated for their action in meat preservation [2,]. Studies conducted on pork meat showed that thyme EO was effective in controlling enterobacteria [2]. Clove EO has been studied for its effects as a natural antioxidant in meat products to improve lipid and protein stability against oxidation, maintain colour, texture, sensory properties, and extend shelf life. Clove is widely used in Mediterranean gastronomy, due to its flavour. One of the challenges in the use of EO in food products is the occurrence of off flavours, but in this case it should not be a defect. To study the effect of clove (*Syzygium aromaticum* L.) EO in meat preservation, commercial meat cuts (secretos), obtained from the *latissimus dorsi* muscle of the cross breed Alentejano X Duroc pig meat (Alentejano is a Portuguese authocthonous breed) were used. Three treatments (control, 50ppm and 500ppm of clove EO) were compared at 0 and 6 months of storage. Microbiological counts of mesophilic and psychotrophic microorganisms, moulds and yeasts and enterobacteria were performed according to ISO 6887-1. Texture evaluation, namely Warner-Bratzler shear force, was performed. Color measurements, L*a*b*coordinates, were evaluated. Sensory evaluation was performed with a trained sensory pannel following international standards (ISO 8586-1; ISO 8589). Statistically significant differences were evalueted by ANOVA test and Tukey's HSD test ($p<0.05$). The treatment with 50ppm of EO exibited statistically significant differences when compared with the control for total mesophilic microorganisms ($p=0.039$) and total psychrotrophic microorganisms ($p=0.043$), which was not the case for the modality of clove EO 500ppm. Regarding moulds and yeasts, no significant differences were observed between the three treatments. Concerning enterobacteria, there are significant differences between the control and the two treatments with clove EO. Regarding texture, significant differences were observed between the control sample and samples from the other treatments (50ppm: $p=0.024$; 500ppm: $p<0.01$), but no differences were found between the two clove EO treatments ($p>0.05$). No differences in colour were observed. Beyond these results, in the sensory analysis the painelists didn't find differences in any of the descriptors presented, and neither identified off flavours. In a global perspective, the use of EO reduces the presence of microorganisms, doesn't cause off-flavours and doesn't alter the colour, so its use for natural meat preservation could be an alternative in the future.

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