

# THE ANTIMICROBIAL EFFECT OF *ORIGANUM ONITES* AND *OCIMUM BASILICUM* ESSENTIAL OILS AGAINST *STAPHYLOCOCCUS AUREUS* IN MINCED MEAT

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**Abstract** – The aim of this study was to evaluate the antimicrobial effect of *Origanum onites* and *Ocimum basilicum* essential oils against *Staphylococcus aureus* in minced meat stored at 4°C for seven days. *In vitro* antibacterial activity of both essential oils showed inhibition against *S.aureus*. Minimum inhibitory concentration value (MIC) of essential oils was determined using the agar dilution method in Muller Hinton Agar. The lowest MIC value was obtained with *Origanum onites* 0.3 µl/ml against *S.aureus* strains. Both essential oils showed a significant decrease in used microorganisms inoculated to minced meat at the end of storage. The concentration of the both essential oils at 20µg/mg and 10µg/mg showed stronger antimicrobial activity against bacterial cocktail of *S. aureus* in minced meat than the concentration of at 5 and 2.5 µg/mg, however, the higher concentrations caused alterations in the taste of minced meat.

**Key Words** –Food safety, meat

## I. INTRODUCTION

One of the most common pathogens causing food borne illnesses is *Staphylococcus aureus*. The growth of *S.aureus* in food presents a potential hazard for public health [9, 3, 19, 1]. *S.aureus* causes Staphylococcal food poisoning (SFP) is a typical intoxication due to enterotoxins ingestion performed in food by the enterotoxigenic strains [3] SFP is widespread in the world. Most of sources of SFP are trace to humans who contamination by food preparers by food preparers [9]

The *in vitro* antimicrobial effect of *Origanum onites* and *Ocimum basilicum* EOs has been studied by several researchers [11, 17,

13, 20, 10, 8, 7, 5, 16]. In recent years, consumers have been interested for more natural products, and led to food industry to consider the natural preservatives in food [3]. In this study, we have searched antimicrobial effect different concentrations of some essential oils on food media.

## II. MATERIALS AND METHODS

*Origanum onites* and *Ocimum basilicum* EOs were obtained from TIKTA (Agricultural Climatisation and Technological Research Corporation Ankara-Turkey). The oils were isolated by hydro-distillation, and their compositions were determined by Anadolu University, Plant Drug and Scientific Research Centre (AUBIBAM Eskisehir, Turkey). Minced meat that is prepared daily and available for sale to consumers in the Tesco Kipa Market (Canakkale) was used in this study and was stored at -18°C until analysis. The protein, fat, and moisture content of the minced meat samples were determined according to AOAC [2] and Vural et al. [22] *S.aureus* ATCC 25923 (Microbiologics-France) and *S. aureus* ATCC 95047 (Izmir Institute of Technology – Turkey) strains were used in bacterial cocktail. *S.aureus* was incubated in Tryptic Soy broth (TSB, Merck, Darmstadt, Germany) until it reached about 8 log CFU/ml.

The Minimum Inhibitory Concentration (MIC) of the EOs against the tested microorganisms was determined using the agar dilution method [14] with one modification: all tests were performed in Mueller Hinton agar (MHA, Merck 1.05437) supplemented with DMSO (highest

final concentration 3%). The final concentration ranges of the EOs were from 0.3 to 20 µl/ml. EOs were added to the minced meat at the following concentrations: 2.5, 5, 10 and 20 µg/g and the minced meat was inoculated with the *S.aureus* cocktail at 5.84 log CFU/g. *S.aureus* enumeration was made on Baird-parker agar (BPA, Merck 105406), incubating the plates at 37°C for 48 h.

The significant difference between the samples was determined by ANOVA variance analysis and Tukey's multiple range tests. Data were analysed using Minitab 15.0 [13].

### III. RESULTS AND DISCUSSION

The composition of the *Origanum onites* and *Ocimum basilicum* EOs are shown in Table 1. The main components of EOs obtained were carvacrol (67.0%) and linalool (40.6%) for *Origanum onites* and *Ocimum basilicum*, respectively. Many of researcher reported that major and minor chemical components of EO performed together against the bacterial cell. This components are phenols, terpenes, aldehyds and ketones [6,12,4] and they disrupted the cell membrane, effect permeability, leakage of various substance such as ions, ATP, nucleic acis and aminoacid and cause the death of cell [6,19,12] It was found that protein, fat and moisture content of the minced meat samples were 18.09±0.75 %, 18.89 ±0.51% and 62.34±0.96 %, respectively. Meat and meat products can have a high fat content and this structure reduce the effect of essential oils against bacteria and support that growing of microorganisms. The EOs of *Origanum onites* and *Ocimum basilicum* had significant inhibitory effects on *S. aureus in vitro*. The MIC value of *Origanum onites* EO was determined as 0.3µl/ml while it was 2.5µl/ml for EO of *Ocimum basilicum* for both *S. aureus* ATCC 25923 and 95047.

The *Origanum onites* essential oils presented more antimicrobial activity than *Ocimum basilicum*. *Origanum onites* EOs at 20, 10 µg/mg concentrations decreased *S.aureus* counts by 1.01 and 0.80 log CFU/g respectively compared to control in minced meat at the end of storage days.

Table 1 Composition of *Origanum onites* and *Ocimum basilicum* essential oils

<i>Ocimum basilicum</i>		<i>Origanum onites</i>	
Contituents	%	Contituents	%
1. β-Pinene	1.0	1. Myrcene	1.3
2. 1,8-Cineole	8.8	2. alfa-Terpinene	1.1
3. Linalool	40.6	3. gama-Terpinene	5.6
4.Trans-β-Bergamotene	2.3	4. <i>p</i> -Cymene	4.9
5.Methylchavicol	28.5	5. Linalool	6.1
6. Germacrene D	1.6	6. beta Caryophyllene	2.0
7. γ-Muurolene	1.1	7. Borneol	2.0
8. Eugenol	1.9	8. beta-Bisabolene	1.0
9. T- Cadinol	2.0	9. Thymol	1.7
		10. Carvacrol	67.0
TOTAL	87.8	TOTAL	92.7

More than 1%.

In this study we can say that *Origanum onites* EO of high concentration (20µg/mg) repressed the growth of bacteria and showed a bacteriostatic effect. Because *S.aureus* counts at the end of seven days (5.92 log CFU/g) stayed almost at initial level (5.84 log CFU/g)

In general, samples treated with EOs showed lower populations of *S.aureus* than control samples. Although the lower MIC values of *Origanum onites* and *Ocimum basilicum* was determined *in vitro*, *S.aureus* showed resistance against higher concentrations of EOs in minced meat. The antimicrobial effects of *Origanum onites* and *Ocimum basilicum* EOs and their concentratios on *S.aureus* in minced meat during seven days at 4°C are shown in Fig. 1 and 2. The type of EOs, concentrations of EOs and storage days' interaction did not significantly affect the growth of *S.aueus* in minced meat ( $p=0.382$ ).

The antibacterial activity of *Ocimum basilicum* and *Origanum onites* EO against *S.aureus* was previously found in vitro studies or in other kind of food. There is not any study that evaluates the effect of these EOs on *S.aureus* in minced meat. However, Tsigarida et al. [21] reported a reduction in initial microflora on beef fillets by 2–3 log CFU/g with the addition of 0.8% of oregano EO. Skandamis et al. [18] reported an

immediate suppression in the total viable count in minced beef by 1 log CFU/g when oregano oil was added at a concentration of 1% which agrees with the findings of this study.

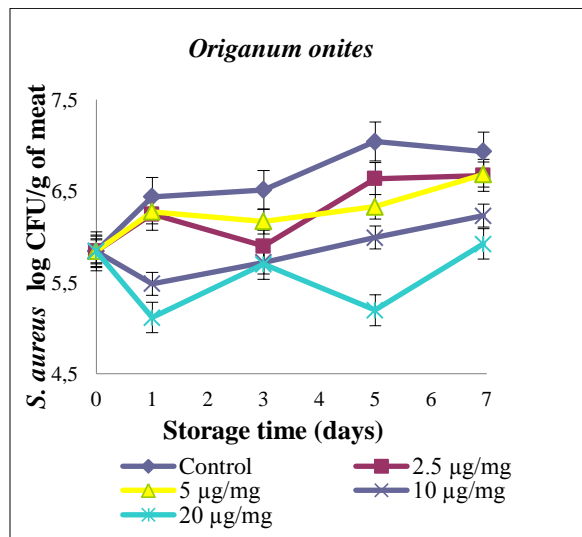


Fig. 1. Effect of different concentrations (20, 10, 5, 2.5, Control µg/mg) of *Origanum onites* essential oil against *S. aureus* cocktail in minced meat during storage (4°C/7days). Error bar shows standards errors.

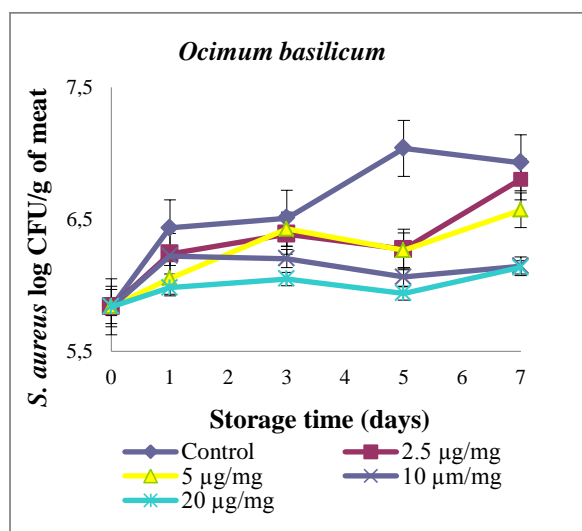


Fig. 2. Effect of different concentrations (20, 10, 5, 2.5, Control µg/mg) of *Ocimum basilicum* essential oil against *S. aureus* cocktail in minced meat during storage (4°C/7days). Error bar shows standards errors.

#### IV. CONCLUSION

The results of this study show that *Origanum onites* EO is more effective than *O. basilicum* EO against *S. aureus* in minced meat during storage at 4°C. However minced meats treated with either EOs more than 5 µg/mg concentrations were not organoleptically acceptable on the day of preparation.

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