

Effect of oregano extract on shelf-life, microbiological quality of chilled chicken carcasses

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Abstract

The combined effect of different concentrations of oregano extract (OE) and packaging method (with air and vacuum) on microbiological quality of chicken carcasses stored at $4\pm 2^{\circ}\text{C}$ was studied. The microbiological parameters were monitored: (mesophilic aerobic bacteria, psychrotrophs bacteria (PSY), *pseudomonas* spp, molds and yeasts, and coliform). The results showed that carcasses samples treated with the concentrations 5% OE and vacuum packaged samples had the longest shelf-life and lowest microbial load, while the air packaged control samples was the highest in microbial load

Keywords

Oregano extract

Chicken meat

Microbial load

Meat quality

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Introduction

Poultry meat is a nutritious food and it is consumed all over the world for its relatively low cost and low fat content. However, it is highly perishable with a relatively short shelf life even when it is kept under refrigeration. Thus, finding an appropriate treatment for its preservation could be highly useful. In order to increase the shelf life of meat products, vacuum-packaging has been used although it has not been able to extend the shelf life of the packaged product for a long time (Mantilla *et al.*, 2011). The combination of different food preservation methods should be as an alternative in the food industry, for example, use of vacuum-packaged, plants extracts and refrigeration. However, in order to ensure that the combined use of those techniques does not produce changes in the original characteristics of the products, test of sensory acceptance must be performed (Mantilla *et al.*, 2011).

The antibacterial activities of spices and its essential oils have been known for a long time, however the relatively recent enhancement of interest in "green" consumerism has lead to a renewal of scientific interest in these substances and their antibacterial properties and potential applications in food products and investigated intensively by scientists (Burt, 2004; Chorianoopoulos *et al.*, 2004). Oregano (*Oreganum vulgare* L), is known to contain naturally occurring compounds with antimicrobial properties. The bacteriostatic/bactericidal effect of

various extracts of oregano on foodborne bacteria including pathogens has been demonstrated in vitro in many studies (Chorianoopoulos *et al.*, 2004; Duman-Aydin, 2008). whereas a few studies have addressed the effect of these compounds on pathogens associated with muscle's foods (Cutter, 2000). In order to prevent or decrease microbial contamination and lipid oxidation in chicken meat, many additives are usually used.

The recently trend is to decrease synthetic additives which have been vastly used because of the growing concern among consumers about their serious effects on human health (Elzamzamy, 2014). Consequently, many natural additives, especially of plant source showed markedly increased in recent years. Therefore, the development and application of natural products with both antioxidants and antibacterial activities especially in meat products may be necessary and useful to prolong their storage shelf life and potential for preventing food diseases (Fernandez-Lopez *et al.*, 2004). There was a few studies about the effect of oregano extract on shelf life of raw meat and its microbial load, Therefore, the purpose of this study was to investigate the effect of the addition of oregano extract at different concentration and method packaging on microbial quality, oxidative stability of chicken carcasses under refrigerated storage.

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Materials and Methods

Preparation of oregano extract (OE)

Water extract of oregano were prepared by adding 20 g of dried ground oregano leaves obtained from local market (Damascus, Syria) to 400 ml of freshly prepared hot water (80°C) for 1 h. The mixture was then cooled to room temperature and filtered through a Whatman No. 1 filter paper (Mohamed, 2011).

Chicken carcasses collection and preparation

Chicken carcasses were purchased immediately after slaughtering from a local commercial source in Masaken Barza, Damascuss and transported immediately to the laboratory. Chickens were divided into four groups and prepared by dipping three of them in different concentration (1.25, 2.5, 5% w/v) of OE at 15°C for 10 minutes, the fourth group was dipped in distilled water as control. Then samles were removed from the solution and allowed to drain on a stainless wire mesh screen for 5 min. Subsequently, the samples were individually placed in sterile polyethylene bag. Two different packing methods, air- packaged and vacuum-packaged were used, then were labeled and stored at 4±2°C. Each sample was microbial analyzed in different periods (0,3,6,9,12 day) for (mesophilic aerobic bacteria, PSY, *Pseudomonas* spp, molds and yeasts, and coliform).

Microbiological test

Chicken samples of 25 g (15 g meat+10 g skin) from the whole chicken carcasses were blended with 225 ml peptone solution (0.1%) for 1-2 minutes. Serious dilution were prepared and the plate count method was used for determination of the numbers of viable organisms. Appropriate media for the particular group of organisms was poured on one ml of each dilution to be tested as colony forming unit per gram (CFU/g). Plate count agar (PCA; Biolife) incubated at 30°C for 72 h for the enumeration of mesophilic aerobic bacteria and same medium was incubated at 5°C for 10 days for the enumeration of psychrotrophic aerobic bacteria. (Mackonky; Difco) for the total coliform was incubated at 30°C for 24 to 48 h. Cetrimide agar (Biolife) for the total *Pseudomonas* count incubation at 25°C for 2 days. Potato dextrose agar (PDA; Biolife) for yeasts and moulds was incubated at 25°C for 5 days.

Statistical analysis

Differences between the variables were tested for significance by one-way ANOVA with Tukey's post test using MINITAB program. Differences at $p < 0.05$

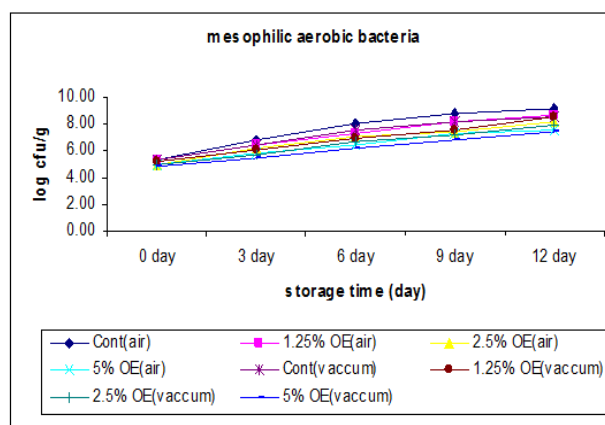


Figure 1. Mesophilic aerobic bacteria count in chicken carcasses samples during storage at 4°C

were considered to be significant.

Results and Discussion

Shelf life extension

Aerobic flora has been used as criteria to predict the shelf life of products (Elzamzamy, 2014), and the maximum count recommended limit for mesophilic aerobic bacteria was 7 log CFU/g set by ICMSF(1986). Figure (1) refers that samples treated with 5% oregano extract and vacuum-packaged exhibited the longest shelf life (10 days), followed the samples dipped in 2.5% OE and vacuum packaged (8 days) samples, then samples dipped in 2.5 and 5% air -packaged samples (7 days), while the control samples air and vacuum packaged had the lowest shelf life (4-5 days respectively) (Figure 1). Chouliara *et al.* (2007) reported that chicken breast meat treated with concentration of the oregano oil (1%) had a much stronger preservative effect than that of 0.1% oregano oil. The concentration of 1% resulted in a shelf-life extension of 19–20 days while the concentration of 0.1% resulted in a shelf-life extension of only 1–2 days.

Heterotrophic aerobic mesophilic bacteria

Treatment with concentration of oregano extract 5% reduced slightly the initial count of aerobic mesophilic bacteria approximately 0.53 log (Figure 1). In this experiment the mesophilic bacteria were not able to grow in anaerobic circumstances as grow in aerobic packaged. This is agreement with the results of bacterial count at the 9th day of storage, the vacuum-packaged samples had lower bacterial count 6.78 log cfu/g in comparison with air packaged 7.37 log. This is similar to results of Jiménez *et al.* (1997) who found a rapid growth of viable bacteria in air-packaged samples more than in vacuum-packaged samples.

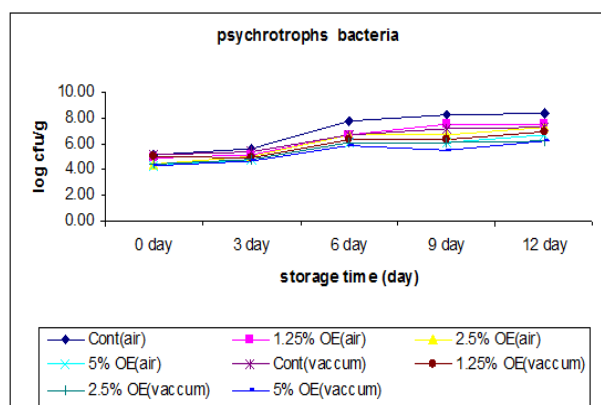


Figure 2. Psychrotrophs count in chicken carcasses samples during storage at 4°C

Our results are in agreement with those of Skandamis and Nychas (2001) who reported a reduction of initial microbial load 0.3-0.9 \log_{10} cfu/g of minced meat immediately after mixing with 1% oregano essential oil. Chouliara *et al.* (2007) noticed that addition of oregano essential oil influenced the microbial load association of minced meat stored under MAP(modified atmosphere packaged), but Vatanserver *et al.* (2008) did not find significant differences ($P>0.05$) in mesophilic aerobic bacteria of drumsticks meat treated with 10% oregano extract and the control.

Psychrotrophs

At initial (day 0) the psychrotrophs (log cfu/g) of chicken carcasses were 5.09, 4.92 in control and treated samples with 5% oregano extract (air-packaged) respectively, and 5.35, 4.83 in control and treated samples with 5% oregano extract (vacuum-packaged) respectively (Figure 2). Data show significant differences in psychrotrophs counts between treated and untreated samples at day (0) (Figure 2). However 5% OE vacuum packaged sample recorded the lowest count (6.14 log CFU/g), followed by samples treated with 2.5% OE and vacuum packaged (6.24 log CFU/g), then samples treated with 5% OE air packaged sample (6.70 log CFU/g), while control air packaged and vacuum packaged samples had the highest counts over the storage period. Results indicated a gradual increase in psychrotrophs counts for all samples during storage, these results was similar to Elzamzamy (2014) who found that psychrotrophs counts increased with storage time, also he noticed that psychrotrophs counts decreased with increasing extracts level.

Yeasts and moulds

Treatment with oregano extract caused a slight decrease in the initial count of yeasts and moulds in all samples by approximately 0.1- 0.3 log (Figure

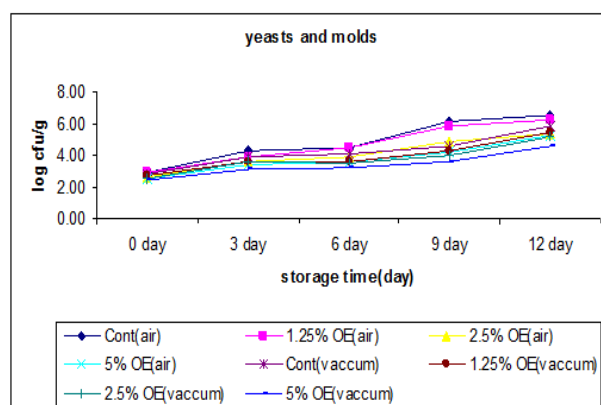


Figure 3. Yeasts and molds count in chicken carcasses samples during storage at 4°C

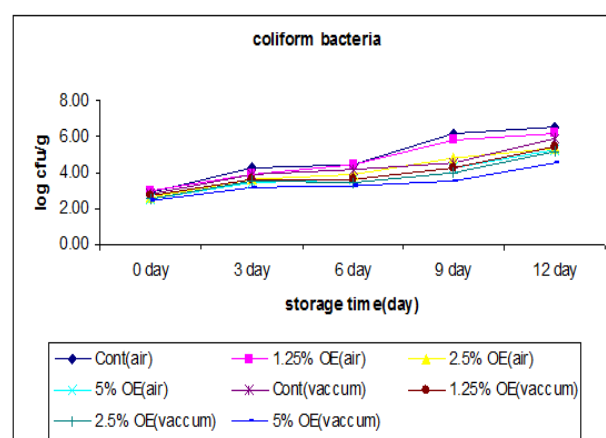


Figure 4. Coliform bacteria count in chicken carcasses samples during storage at 4°C

3). In the present experiment the yeasts and molds were not able to grow in vacuum as they grew more easily in air. This is in agreement with the results of bacterial count at the end of storage, since the vacuum-packaged samples had lower bacterial count 6.78 \log_{10} /cfu/g in comparison with air packaged 7.37 log.

Coliforms

A decrease in coliform count was parallel to the increase in oregano extract level where counts at days 3, 6 and 9 was 3.65- 3.58, 3.87- 3.5 and 4.83- 3.97 log CFU/g in 2.5%OE air and vacuum packaged samples respectively, 3.44- 3.15, 3.64- 3.26 and 4.23- 3.59 log CFU/g in 5%OE air and vacuum packaged samples to 4.31- 3.93, 4.5- 4.14, and 6.17- 4.59 log CFU/g in control air and vacuum packaged samples respectively (Figure 4). Vatanserver *et al.* (2008) did not find differences between untreated and treated raw broiler drumstick with oregano extract for coliform count.

Pseudomonas

Dipping chicken carcasses in OE achieved an immediate reduction in Pseudomonas counts by

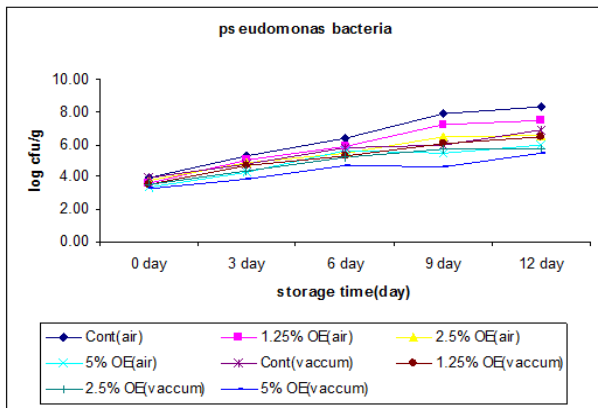


Figure 5. *Pseudomonas* bacteria count in chicken carcasses samples during storage at 4°C

approximately 0.5-1 log as compared to the untreated control (Figure 5). Data show that *Pseudomonas* counts of chicken meat increased during storage at 4°C. Samples treated with OE and vacuum packaged have lower count of *Pseudomonas* than treated and air packaged samples. Chouliara *et al.* (2007) found that Oregano oil was more effective than modified atmosphere packaged (MAP) in reducing *Pseudomonas* counts, also Scandamis *et al.* (2002) reported that *Pseudomonas* were the most resistant bacterial group to oregano oil.

Conclusion

The use of vacuum packaged combined with dipping chicken carcasses with oregano extract were more effective microbial load reduction than the air packaged one.

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