EVALUATION OF THYME AND ROSEMARY OILS AS ANTIMICROBIAL AND ANTIOXIDANT AGENTS IN BEEF BURGER

By

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B.Sc. Agric. Sci., Fac. Agric. (Moshtoher), Zagazik Univ.,2000

THESIS
Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

In

Agricultural Sciences
(Food Science)

Department of Food Science
Faculty of Agriculture
Cairo University
EGYPT

2014

APPROVAL SHEET

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Title of Thesis: Evaluation of Thyme and Rosemary Oils as Antimicrobial and Antioxidant Agents in Beef Burger
Supervisors: Dr. Abd El-Rahman, M. Khalaf Allah
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ABSTRACT

The present study was carried out to evaluate the effect of essential oils of thyme (*Thymus vulgaris L.*) and rosemary (*Rosmarinus officinalis L.*) at concentrations of 200 and 300 ppm, on the quality of fresh beef burger and during frozen storage at -18ºC for 4 months. The results indicated that addition of the essential oils under study, to beef burger had no effect on the chemical composition and the pH value of the produced burger, while slightly decrease in water holding capacity and cooking loss was observed compared to control through the storage time. Control sample showed highly increase in TVN(191.3%), while the treated samples showed lowest increase especially with the high dose level (300 ppm of both oils) since, it varied between (29.67% to 39.41%). These results indicated that the essential oils had an antimicrobial effect against total bacterial count, psychrotrophes, coliform group, *Staph. aureus* and Salmonella. Essential oils of thyme or rosemary had also antioxidant activity as indicated by TBA test.

Key words: beef burger, quality characteristics, thyme, rosemary, sensory properties, antioxidants.

ACKNOWLEDGMENT

Firstly, many thanks to Allah for his blessing, mercy and grace to complete my thesis successfully.

Special thanks and appreciation to ***Dr, Abd El-Rahman, M. Khalaf Allah.*** *Professor of Food Science, Faculty of Agriculture, Cairo University, for his continuous support of my study, patience, motivation, enthusiasm, immense knowledge, endless encouragement, noble supervision, planning this study, valuable advices, generous and continuous support throughout the work and correcting my thesis.*

Deep thanks to ***Dr. Mahmoud, A. Bekheit,*** *Associate Professor of Food Science, Faculty of Agriculture, Cairo University, for his endless encouragement, sincere help, keen supervision, scientific advises, guidance through the study and revision the manuscript of this thesis*

DEDICATION

I dedication this work to whom my heart felt thanks to my mother who planted in me the education liking and who dose her best for me.

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INTRODUCTION

Meat is the essential component of a healthy and well balanced diet owing to its properties as a source of high-quality protein, high-available iron, essential fatty acids and B-group vitamins (Biesalski, 2005).Many efforts have been made to improve the quality and stability of meat burgers because of consumer demand for fast food which has been increasing rapidly in the recent years. Most of the products used in fast food are rich in fats and sugars, but deficient in complex carbohydrates (Papadina and Bloukas 1999). Prevention of lipid oxidation in processed meat products is an important for keeping their high quality and safety. It is obvious that natural antioxidants are preferred. Many works are connected with the use of extracts from different herbs (Zarena and Sankar 2009; Roman *et al.* 2009 and Kobus-Cisowska *et al.* 2010).Various extracts separated from natural sources (e.g. rosemary, oregano, sage and thyme) have proven to possess strong antioxidant activity due to their high content of phenolic compounds, and they are permitted for using in food to replace synthetic antioxidants such as BHT/BHA (Ahn et al., 2007). Rosemary (*Rosmarinus officinalis*) is a small ever-green plant, belonging to the Labiatae family. It grows principally in the basin of the Mediterranean region, while in Poland it is usually cultivated

in pots. Active substances present in rosemary possessed series of properties, that desirable from the point of view of the food industry and medicinal phytology (Djeddi et al., 2007).Rosemary extract, in the form of an emulsion, powder or oil solution, might be used as a substitute for BHA (butylated hydroxyanisole), in dehydrated chicken eggs, meat and fish. While, rosemary extracts might be added to sausages, macaroni, peanut butter and oil. Essential oils and extracts, obtained from rosemary are characterised by a high antimicrobial activity. Bacterial strains, especially, susceptible to the activity of essential rosemary oils include: *Enterococcus faecalis, Staphylococcus aureus, Staphylococcus epidermidis, Bacillus subtilis and Klebsiella pneumoniae* (Mangena and Muyima 1999; Celiktas et al., 2007and Djeddi et al., 2007). *Thymus vulgaris* L. (thyme), locally known“zaatar” or“zaitra’, a member of the family Lamiaceae, is widely used in Morocco folk medicine for its expectorant, antitussive, antibroncholitic, antispasmodic, anthelmintic, carminative and diuretic properties. The aromatic and medicinal properties of the genus thymus have made it one of the most popular plants all over the world. Thymus species are commonly used as herbal tea, flavoring agents (condiment and spice) and medicinal plants (Stahl-Biskup and Saez 2002). These antimicrobial properties are

related to the chemical composition of the oils, which varies within the different species of the genus thymus and even within the samples of the same species (Granger and Passet 1973).

The aim of this study was to investigate the effect of essential oils of thyme and rosemary on retarding lipid oxidation in beef burger during frozen storage. Also, to study the effect of tested essential oils on the microbial load of beef burger samples as well as sensory evaluation of beef burger samples during storage. With this in view, this work has been to:

1-Evaluate the effect of adding different concentration of thyme and rosemary essential oils during frozen storage (-18˚C) on:

a)Chemical, physical and physicochemical properties of beef burger.

b) Microbiological characteristics of beef burger.

c) Sensory characteristics of beef burger.

2- Evaluate thyme and rosemary essential oils as antioxidant and antimicrobial agents.

REVIEW OF LITERATURE

1. Chemical composition of thyme's essential oil

Farrell (1999) reported that the volatile oil components of thyme were known to include carvacrol, borneol, geraniol, but the most important is thymol. Thyme also contained a variety of flavonoids, include apigenin, naringenin, luteolin and thymonin. These flavonoids increased thyme's antioxidant capacity. He also found that the ground thyme contained 7.89 g water, 9.1g portion, 7.4 g fat, 63.9 g total carbohydrate, 18.6 g fiber and 11.7 g ash per100 g edible portion and no less than 0.8 ml of volatile oil (vol. / wt).

Jord´an *et al.* (2006) reported that for the Spanish *Thyme vulgaris* essential oil, the major components quantified were 1,8-cineole, followed by terpenyl acetate, borneol, linalool, pinene, terpineol, and camphor. With respect to the concentrations of some of the most abundant components, the mid-vegetative stage seemed to be the most appropriate harvesting time. Cineol, borneol, monoterpenic hydrocarbons, and camphor exhibited their maximum relative concentrations at this phenological stage. In contrast, terpenyl acetate, terpineol and linalool, probably components that were associated with the fresh aroma in the oil, were mostly concentrated from full bloom to advanced fruit formation.

Thyme was analysed by Imelouane *et al.* (2009) using GC/MS. They found that forty three compounds consisting 97.85% of the total components could be identified from the oil obtained. Among those, camphor camphene (17.19%), á-pinene (9.35%), 1, 8-cineole (5.44%), borneol (4.91%) and â-pinene (3.90%) were the major oil components.

a. Thyme as antioxidant agent

Abd-El-Alim *et al*. (1999) studied the antioxidant effect (as evaluated by TBARS values) of dried thyme on the oxidative stability of fresh minced chicken meat. They found that application of dried thyme to chicken meat inhibited lipid oxidation in frozen samples and addition of thyme to meat reduced the TBA values. They concluded that natural antioxidants, such as thyme, might be used to extend the shelf life of meat products.

Yasin and Mohamed (2007) studied the effect of thyme oil at addition levels of 2.5 or 5% as antioxidant agent in semi fried mullet fish fillets during cold storage period. They found that the lowest TBA values were observed for sample coated with 5% thyme.

Istrati *et al.* (2011) indicated that marinades consisted of dry red wine, lime-tree honey, salt, spices and seasoning plants as thyme (*Thymus vulgaris*), marijoram (*Majorana hortensis*), garlic (*Allium sativum*) and