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STUDY THE EFFECT OF ROSEMARY AND CARDAMOM OILS ON SOME QUALITY PARAMETERS OF BEEF SAUSAGE DURING FREEZING STORAGE

(With 7 Figures)

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دراسة تأثير زيوت الروزماري والحبهان على بعض خصائص الجودة للسجق البقري أثناء حفظه بالتجميد

عزة حسين أحمد

تم إضافة زيوت الروزماري و الحبهان كل على حدة أثناء تصنيع سجق بقرى لدراسة تأثيرهما على بعض خصائص الجودة للسجق و مدى ثباتها أثناء التجميد عند -١٨ °م لمدة ٩٠ يوما. أيا من زيت الروزماري والحبهان لم يعطي تأثيرا على محتوى الرطوبة و قيمة الأس الهيدروجيني لعينات السجق كما أن عملية الطبخ أدت إلى نقص نسبة الرطوبة و زيادة قيمة الأس الهيدروجيني بينما وجد انخفاض قليل بالقيمتين أثناء الحفظ بالتجميد. تم انخفاض قيم كل من القواعد النيتروجينية المتطايرة و رقم حمض الثايوباربتيوريك في عينات السجق المعالجة بهذه الزيوت كما أدت عملية الطبخ و التخزين بالتجميد إلى انخفاض هذه القيم بالمقارنة بالعينة الضابطة. إضافة زيت الروزماري والحبهان لعينة السجق أدي إلى تحسين نسبة الفقد بالطهي و القدرة على الاحتفاظ بالماء مقارنة بالعينة الضابطة كما أدي التخزين بالتجميد إلى تناقص القدرة على الاحتفاظ بالماء و زيادة الفقد بالطهي في كل عينات السجق. في عينة السجق المعالج بزيت الحبهان حدث تناقص في أعداد الخلايا البكتيرية الحية (المحبة للبرودة و العد البكتيري الكلى) و أعداد بكتريا القولون مقارنة بعينة السجق المعالج بزيت الروزماري أو العينة الضابطة كما لوحظ تناقص عام في المحتوى البكتيري للعينات أثناء التخزين بالتجميد.

SUMMARY

Rosemary and cardamom oils were added separately during preparation of beef sausage to study their effect on some sausage quality parameters and its stability during freezing storage at – 18 ° C for 90 days. Either rosemary or cardamom oil had no effect on moisture content and pH values of the examined sausage. Cooking process decreased moisture content and increased pH values, whereas, they slightly decreased during

freezing storage. Total volatile base-nitrogen content and thiobarbituric acid values were reduced in sausage samples treated with oils. Also, cooking process and freezing storage had a role in reduction such values in comparison to the control sample. Addition of rosemary and cardamom oils to sausage samples improved the water holding capacity and cooking loss than the control one. Freezing storage decreased the water holding capacity and increased the cooking loss in all sausage samples. Sausage treated with cardamom oil was progressively reduced the total viable bacterial count (psychrotrophs and mesophiles) as well as coliform count compared with sausage samples treated with rosemary oil or the control sample. It was observed a general loss in the bacterial load during freezing storage.

Key words: *Rosemary and cardamom oils, quality parameters, beef sausage*

INTRODUCTION

Sausage is a food that is prepared from comminuted and seasoned meat and is usually formed into a symmetrical shape. The overall quality of meat sausage is affected by the method of processing, length of storage and the various formulated ingredients (Reagan *et al.*, 1983). Total volatile bases nitrogen (TVB-N) is an index to the degree of purification and breakdown of proteinious constituents. The thiobarbituric reactive substances (TBARS) are an indicator for development of oxidative rancidity in meat products. Ho *et al.* (1995) found that the TBARS values for fresh pork sausage patties increased after frozen storage at – 20 ° C for 16 weeks. They concluded that the rosemary extract was effective as an antioxidant in sausage product. Water-holding capacity (WHC) was identified as the ability of meat and meat products to hold its own or added water during application of any force, on the other hand, cooking process reduced WHC due to denaturation of protein (Hashem *et al.*, 1978). Cooking losses in sausages were parallel to the increase of fat content and the storage period (Salama *et al.*, 1994). The bacteriological load of meat products depends upon the microbial load of the raw meat used for grinding, sanitary conditions, and time and temperature of storage. The sources include spices, condiments, salt and natural casings. Amar *et al.* (1988) found that the number of microorganisms in cow meat markedly and progressively decreased upon prolonged frozen storage at –20° C. Decontamination of fresh sausage form spoilage and pathogenic

microorganisms is important to eat and the shelf life and insure their microbial safety for this purpose chemical preservatives are used in sausage but it has been legally prohibited in many countries (Wierbicki and Brynjolfsson, 1979). Therefore, a great trend has been observed in using natural products as natural antioxidant (Andress and Duxbury, 1990). Rosemary extract has fairly broad range of activity against Gram-positive and Gram-negative bacterial (El-Gayyar *et al.*, 2001). Meanwhile, Lopez-Bate *et al.* (1998) reported that rosemary oil could improve the oxidative stability of raw and precooked broiler meat product during refrigerated storage. On the other hand, Morris *et al.* (1979) stated that cardamom oil provides a powerful means for inhibiting the growth of many microorganisms. Simik and Gorisek (1983) studied the bactericidal effect of some spices and recorded that cardamom is one of the most effective antibacterial spices in food. Also, Badei *et al.* (1991) reported that the cardamom fruits and their essential oil are widely employed for flavoring of various food products. The objective of this investigation was to evaluate some quality parameters (moisture, pH, VBN, TBA, WHC, cooking loss and viable bacterial count as well as coliform count) of sausage processed and treated with rosemary and cardamom oils and its stability when stored at –18°C for 90 days.

MATERIALS and METHODS

Preparation of extract:

Rosemary and cardamom spices were purchased from Giza market, ground to fine particles then used as the method applied and recommended by Hallabo (1977), to extract their essential oils, where they were stored in dark bottles and kept in refrigerator at 5 ° C.

Laboratory sausages were prepared from frozen beef meat as described by Attia (1989). The obtained emulsion was then stuffed in cleaned natural mutton casings for control samples. The other treated sausages were prepared by adding rosemary and cardamom oil extracts at levels of 1500 ppm for each and the emulsions also were stuffed in the mutton casings.

All sausage samples were placed individually in fibrous plates, 10/plate, packaged in polyethylene bags and frozen stored at –18 ° C for 90 days, which periodically withdrawn every month to evaluate some quality parameters.

1. Moisture content was determined according to the method of AOAC (1990)

2. pH value was determined according to the method of Chambers *et al.* (1981)
3. Determination of total volatile bases nitrogen (TVB-N) was determined according to Myansyemela (1993)
4. Thiobarbituric acid value (TBA) analysis procedure of Ke *et al.* (1984) was used to determine oxidative rancidity. The samples were analyzed before and after cooking in boiling water for 15 minutes.
5. Water holding capacity (WHC) of cooked sausages was measured using filter paper press method described by Hamm (1972).
6. Total cooking loss of sausage samples were determined as recommended by Salama *et al.* (1994). After boiling the sausage in water then frying in cotton seed oil at 110 ° C for 5 minutes calculate cooking loss as follows:

$$\text{Total cooking loss \%} = \frac{\text{fresh samples weight - fries samples weight X 100}}{\text{fresh sample weight}}$$

7. Total aerobic counts were determined as recommended by APHA (1992). The plates incubated at 25°C for 72 hours for psychrotrophic count and 37°C for 48 hours for mesophilic count.
8. Coliform count was determined according to method used by APHA (1960).

RESULTS and DISCUSSION

Effect of rosemary and cardamom oils on some quality parameters of beef sausage during freezing storage.

Fig. (1) showed that at 0 time of storage, moisture contents of the treated uncooked sausage samples wit h rosemary or cardamom oil were slightly affected as the contents were 68.65% and 69% compared to the control one which had 68.50%. It was observed that the moisture content of all samples decreased slightly during subsequent freezing storage. This decrease might be due to the evaporation of water loss of drip during thawing of sausages, as reported by Sharaf (1983).

On the other hand, cooked sausage samples had lower moisture content than the uncooked samples. In this concern, cooking lowered the moisture content of sausage. These results coincide with those reported by Hashem *et al.* (1978) and Bakr (1992) where they attributed the loss in moisture content of cooked sausage to the partial denaturation by cooking. In Fig. (2) there was no difference occurred in pH values between the uncooked sausage samples at zero time, although it decreased as the storage time increased and this is due to the breakdown of glycogen to produce lactic acid. Similar results were obtained by El-Shawaf (1990) and Ho *et al.* (1995). The corresponding cooked samples

had higher pH values as compared to the uncooked ones, this might be due to the increase in the sulphydryl group and cleavage of hydrogen sulphide in meat protein after heating and / or the increase of the basic groups on the protein molecule that occurred upon heating of meat muscle (Hamm and Detheragee, 1960). From the results achieved in Fig. (3) total volatile bases nitrogen (TVB-N) content of uncooked treated sausage samples decreased at zero time, whereas, it was increased at considerably higher rates during frozen storage. This finding was concluded by Foda *et al.* (1984). The increase of TBV-N in meat product through storage was due to the effect of microorganisms as well as autolysis process as reported by Hashem *et al.* (1978). Regarding the cooked samples, TVB-N was found to be lower than uncooked samples and increased at higher rates throughout storage however, the lowest increase in TVB-N was observed in sausage treated with cardamom oil. These findings were supported by Salem *et al.* (1985).

Thiobarbituric acid value (TBA) is an indicator for development of oxidative rancidity in sausage samples, Fig. (4) showed that TBA values for all samples increased over storage, these results were in agreement with that reported by El-Wakeil *et al.* (1994). Whereas, the lowest value of TBA was recorded in samples treated with cardamom oil followed by that treated with rosemary oil, this might be due to the leaching of some monaldehyde from sausage during cooking as reported by Abu-Salem *et al.* (1985). In general, it was clear that addition of cardamom oil is more effective as antioxidant than rosemary oil in lowering TBA value. This finding was supported by Ho *et al.* (1995).

Water holding capacity (WHC) of meat products is an important character that greatly affect the eating quality of the product (Miller *et al.*, 1980). Fig. (5) revealed that the highest WHC (least area of free water) was recorded for sausage treated with cardamom oil, followed by sausage treated with rosemary oil, then the control sausage. This indicated the effectiveness of using cardamom and rosemary oil in improving WHC of the sausage. These results coincide with those obtained by Abu Mosallam (1996) who reported that adding emulsifiers increased the ability of the system to bind more water and produced more stable sausage emulsions. The highest WHC of sausage treated with cardamom oil might suggest that cardamom oil could be more hydrophilic in nature than rosemary oil. Meanwhile during frozen storage, the WHC of all cooked sausage samples progressively decreased, possibly due to protein denaturation and/or aggregation (Ali,

1986), or the biochemical changes associated freezing of meat products (Salama *et al.*, 1994).

Cooking losses in sausages were influenced by cardamom and rosemary oils as well as freezing (Fig. 6). The control sample showed an increase in the total cooking losses when compared with that treated with cardamom or rosemary oil. The cooking losses progressively increased throughout period of frozen storage up to 90 days, this was in parallel to the decrease in the WHC for all examined sausage samples. These results confirm those reported by Salama *et al.* (1994). Hence adding cardamom oil to sausage reduced cooking loss and increase cooking yield, this could be related to the effect of this oil in reducing the rendering rate of fat and juice during cooking. Total viable counts and coliform count were determined in all tested samples and data in Fig. (7) showed that psychrotrophic, mesophilic and coliform counts ranged form 5.57 to 5.17, 5.47 to 4 and 4.9 to 3.07 log cfu/g, respectively. These results were in accordance with that findings of Dominquez *et al.* (1989) and El-Shawaf (1990). It was clearly indicated that cardamom oil decreased the total viable count (either psychrotrophs or mesophiles) and coliform count also rosemary oil was found to have the same effect, but with lower extent. Simik and Gorisek (1983) and Badei *et al.* (1991) mentioned that the efficacy of cardamom oil against microorganisms is related to its component of α-terpinyl acetate.

Generally, throughout the freezing storage the aforementioned bacterial counts were reduced due to the lethal effect of freezing on the microorganisms as reported by Amar *et al.* (1988) and El-Shawaf *et al.* (1990).

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Results and Discussion

Effect of rosemary and cardamom oils on some quality parameters of beef sausage during freezing storage.

Fig. (1): Moisture content

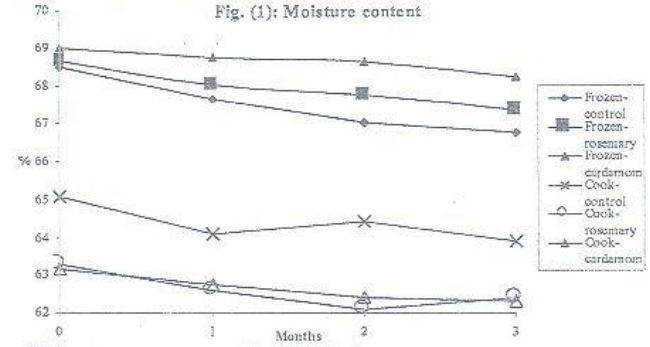


Fig. (2) pH values

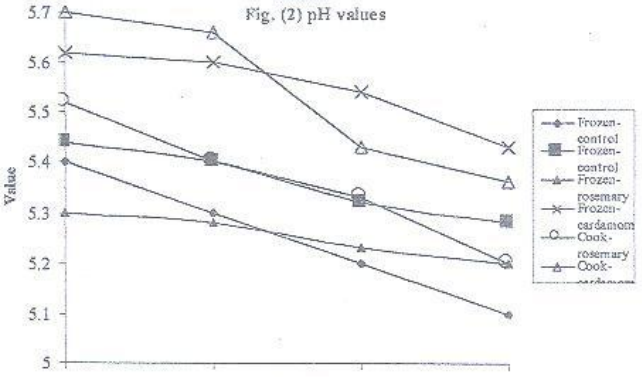


Fig. (3) TVB-N content

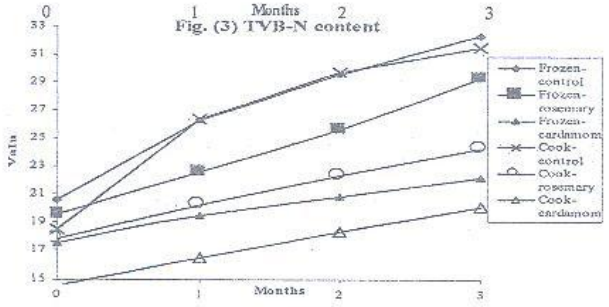


Fig. (4): TBA values

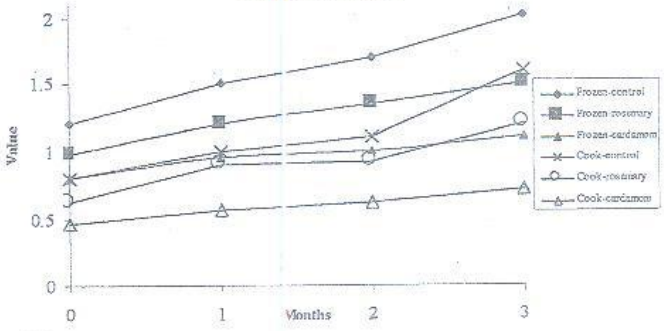


Fig. (5): WHC

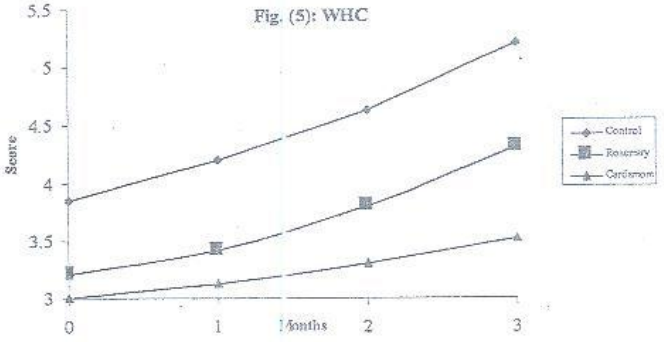
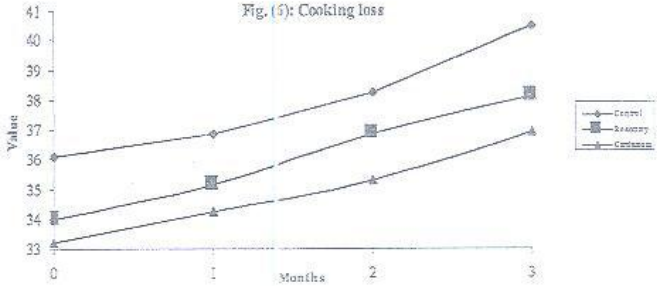


Fig. (6): Cooking loss



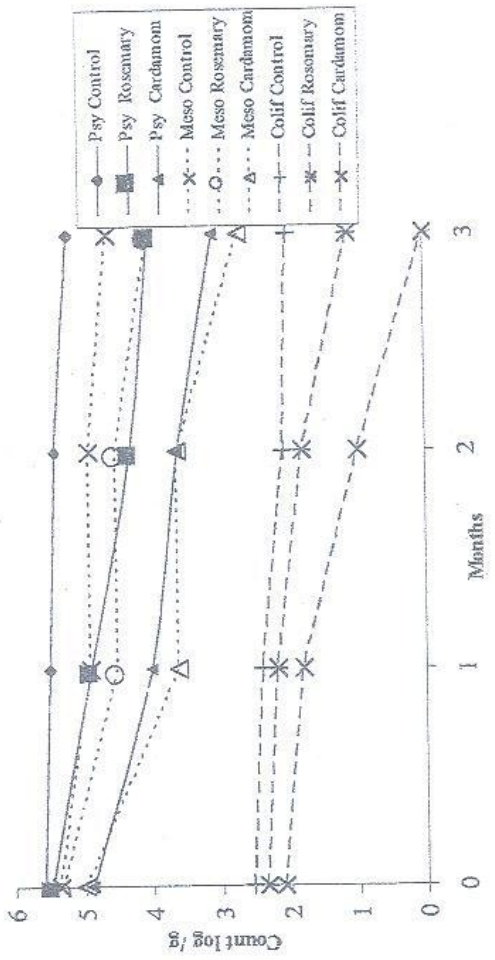


Fig. (7): Bacterial count