RESEARCH NOTE

EFFECT OF VARIOUS ANTIBIOTIC APPLICATIONS ON SOME CHEMICAL, MICROBIAL AND PHYSICAL PROPERTIES OF LAMB

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Accepted for Publication February 14, 1999

ABSTRACT

This study was carried out to investigate the effect of various application methods for a chlortetracycline (CTC) and oxytetracycline (OTC) combination (0.9 mg of each per kg of meat) on the shelf-life of lamb during storage. Twelve-fat, tail type Akkaraman male lambs were divided into four groups by a "block assignment method". The first group was kept as the control (C), while the others were subjected to applications as "injection antemortem (A)", "immersion (I)" and "spraying (S)". Meat samples were stored at 4C for 12 days. The specimens from loin and leg were tested for microbial, chemical and physical criteria. The results indicated that a CTC and OTC combination extended the shelf-life of lamb at 4C in an increasing order from A to S to I. The last one may be used to extend the shelf-life of lamb during refrigerated storage.

INTRODUCTION

Inadequate storage conditions for meat in the eastern parts of Anatolia are major, food hygiene and technology problems in Turkey. Improving the chemical and microbial quality of meat is essential. Suitable antimicrobial substances such as Chlortetracycline (CTC) and Oxytetracycline (OTC) may improve safety and shelf-life of lamb under refrigerated storage.

Numerous studies indicate that it is possible to obtain an improved hygienic level by means of antibiotics applied to meat (Pearson 1970; Naik and Misra 1980; Fang and Lo 1994).

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Studies regarding the effects of antibiotics on chemical properties of meat are quite limited. Most of them were done antemortem (Lowman *et al.* 1991; Baecom *et al.* 1988). But in these studies no effect was observed on carcass characteristics such as fat ratio, confirmation and pH level. Tropilo and Zajaczkowska (1992) used intramuscular injection of OTC without significant effects on color, aroma or texture of rabbit meat.

According to Vaughn and Stewart (1960) the use of CTC and OTC was allowed for a short period about twenty years ago, but the practice was discontinued because of resistant bacterial strains. Worse of all, because there is no agent or organization in Turkey like the Food Safety and Inspection Service of the United States Dept. of Agriculture, Turkey faces inappropriate uses of antibiotics without any strict control. Therefore the disadvantages of antibiotics on meat should be recognized and maintained with strict control on the kind of application. Use of antibiotics that cause toxic and allergic reactions, bacterial resistance and cumulative effect in the human body should not be allowed.

Our objective was to investigate the effects of various antibiotic applications on the pH level, amount of crude lipid and protein, water content, TBA value, ash, color and microbial quality of lamb during refrigerated storage at 4C.

MATERIALS AND METHODS

Twelve Akkaraman male lambs of the same age (11-12 months old), same carcass weight and conformation were purchased from a local market. They were divided into four groups by a block assignment method. The first group was kept as a control. They were slaughtered and their legs dissected. Dissection was applied to the hot carcasses between the 6 and 7th thorocal vertebrae (from foramen spatium intervertebrale). Dissection between 6 and 7th thorocal vertebrae continued to the ventral part with a transversal incision and was completed as a dissected leg containing the Psoas major (a loin muscle) and the Tensor fasciae latae (a leg muscle).

Antibiotic Applications

No antibiotic application was applied to the control. For the second group of three lambs, homogenized solution of CTC and OTC which was prepared in 0.9 physiological saline to provide 0.9 mg of each antibiotic/kg live weight was intramuscularly injected antemortem. The injection sites were the dorsal part of the hind shank, center of the round and center of the rump. Injections were applied to the same regions on both sides of each carcass. The CTC source was

"Devamisin" tablets (Eczacibaşi, İstanbul, Turkey), which contains 500 mg CTC/tablet, and for OTC "Geosol" (Eczacibaşi, İstanbul) a powder containing 55 mg OTC/g were used. Four hours after the six injections the three lambs were slaughtered and their legs dissected between the 6 and 7th thorocal vertebrae as previously described.

After slaughtering the third group of lambs, the legs were dissected similarly. A homogenized solution of a CTC and OTC mixture in 10 L water was prepared to contain 0.9 mg of each antibiotic/kg dissected leg weight. 5 L of this solution was sprayed onto the leg on one side and 5 L on the other leg.

The legs obtained from the fourth group of slaughtered lambs were immersed in 10 L homogenized aqueous solution of CTC and OTC mixture at the antibiotic concentrations specified above.

The nine legs treated with antibiotics were chilled in a cold room for 24 h. After chilling, these legs were transferred to 4C storage. Finally, they were packed and coded as (A), (I) and (S) as all in aseptic and plastic bags. They were not closed so as to be in contact with natural microflora of the refrigerator. The aim of the packaging was only to avoid cross contamination between the legs.

Bacteriological Analysis

TMAB (Total Mezophile Aerob Bacteria) counts were made by applying pour plate technique method (Harrigan and McCance 1976). PCA (Plate Count Agar, Difco-0479) was used as the medium. Areas of 1 cm^2 were marked on the surfaces of the legs and loins. Specimens weighing 1 g from each of the three marked areas were cut by using sterile knifes and placed in sterile petri dishes. They were ground manually by using sterile knife and pens, then transferred to test tubes each containing 9 mL of 0.9% physiological saline. Homogenization of solutions in test tubes was made by using a Vortex machine. Finally dilutions between 10^1 and 10^7 were prepared; 1 mL from each dilution was transferred into the petri dishes (14 mm); PCA medium was added and plates were incubated at 37C for 48 h. After incubation, colonies were counted and expressed as CFU (Colony Forming Unit)/g ground meat sample. The counts were made on days 0, 3, 6, 9, 10 and 11 days of storage.

Chemical Analysis

All chemical analysis were carried out for each sample at 3-day intervals. Areas of 5 and 10 cm^2 were marked on the surfaces of the legs and loins. The distillation method of Tarladgis *et al.* (1960) was used to measure 2-Thiobarbutiric acid reactive substances (TBARS). Specimens weighing 10 g from each of three marked areas were cut, ground and homogenized in 0.1 L of distilled water (Horwitz *et al.* 1975) to determine pH, measured with a digital pH meter

(Heidolphschott, Maintz). Five gram samples from each of three marked areas (5 cm^2) as ground meat were kept at 105C to reach a constant weight (Horwitz *et al.* 1975). Ash trays were incubated in an oven and then cooled in a dessicator and tare weights taken, 5 g specimens were placed in the ashtrays and combusted completely at 550-570C. When the specimens turned white and their weight was constant, they were cooled in a desiccator. The amounts of crude protein of specimens were determined by the Macro-Kjeldahl method (Horwitz *et al.* 1975). Crude lipid was determined by the Soxhlet method (Horwitz *et al.* 1975).

Specimens were taken from both leg and loin parts of each carcass in each application and control group. All chemical determinations were triple replicated.

Residue Analysis (Stop Test)

The antibiotic residues were determined by using the Stop test described by Johnson *et al.* (1981). In this test, Selenite Sistin Agar (Merck 7667) and *Shigella* were used as the test medium and test microorganism, respectively.

To determine the difference between various kind of antibiotic applications, multivariate statistical analysis (MVA) (Richard and Wichern 1987) and Variance analysis (Scheffé 1970) were applied. The degrees of differences between applications were determined by Duncan's Multiple Choice test (Scheffé 1970).

RESULTS AND DISCUSSION

The water content was higher in the antibiotic application groups than in the control as implicated by MVA and Duncan's test. As a natural result of this, other values, i. e., the crude protein, lipid and ash in these groups fall below the control. The effect of storage time on the water content (Table 1) was significant ($p<0.01$). The highest water contents (immersion and spray) possibly resulted from the aqueous solution applied.

The effect of storage time on crude protein, crude lipid and ash amounts was significant (Table 1). This can be due to the increase of dry matter content resulting from the loss of water content during storage. The effects of antibiotic applications and tissue difference (leg or loin) were significant ($p<0.05$) for crude protein amount, but was non significant for lipid and ash amounts. The crude protein content of loins was less than that of the legs ($p<0.05$) which can only be explained by the higher water content of the loins than of the legs.

Multivariate Statistical Analysis showed a significant effect of the storage time on the pH values of lamb (Table 1). Tissue differences between leg or loin had a significant effect on pH values ($p<0.01$). According to Duncan's test, there was no significant difference among the antibiotic application methods. Similar to pH, difference among antibiotic application methods was nonsignificant while tissue differences and storage time had a significant effect on TBA values ($p<0.01$).

TABLE 1.
THE EFFECTS OF CUT, STORAGE AND ANTIBIOTIC ON QUALITY OF LAMB, IMPLICATED BY MVA

	Cut effect	Storage effect	Antibiotic effect
Water	-	++	+
Protein	+	++	+
Lipid	-	++	-
Ash	-	++	-
pH	++	++	-
TBAR	++	++	-

Table 1
(-) : non significant
(+) : significant as $p<0.05$
(++) : significant as $p<0.01$

Color values of the legs were determined on days 0 and 7 of storage. According to MVA, the effect of storage time on the L values of Lamb was not important ($p>0.01$), while it was important for a (red/green)and b (yellow/blue) values ($p<0.05$). The effect of one week interval on the "a" and "b" values of lamb meat may be due to the myoglobin oxidation which spontaneously happens in meat tissue over time. The same analysis indicated a significant effect of the application method on "L"(brightness) values of lamb ($p<0.01$). Duncan's test which was applied to determine the degree of difference among antibiotic applications showed that this effect was more important and significant for the spray and immersion treatments than the control and antemortem treatments ($p<0.01$).

TMAB counts are given in Fig. 1, where the control reached above the legal level 1×10^6 cfu/g in the shortest storage time. The Antemortem treatment reached the same level 3 days later. For the immersion group, the shelf-life was extended up to 10 days and for the spray group 11 days.

Like some of the other parameters, tissue differences ($p>0.01$) did not differ significantly on TMAB counts.

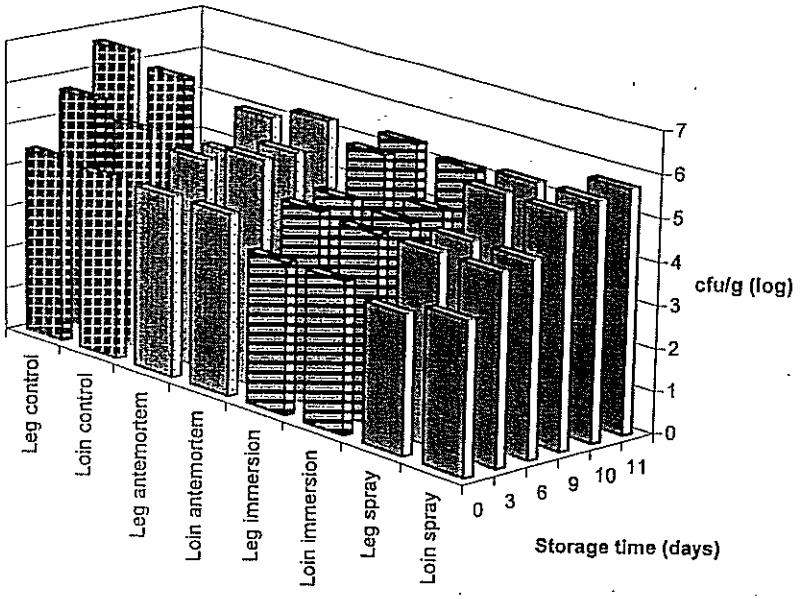


FIG. 1. TMAB OF CONTROL AND ANTIBIOTIC APPLIED MEATS DURING STORAGE

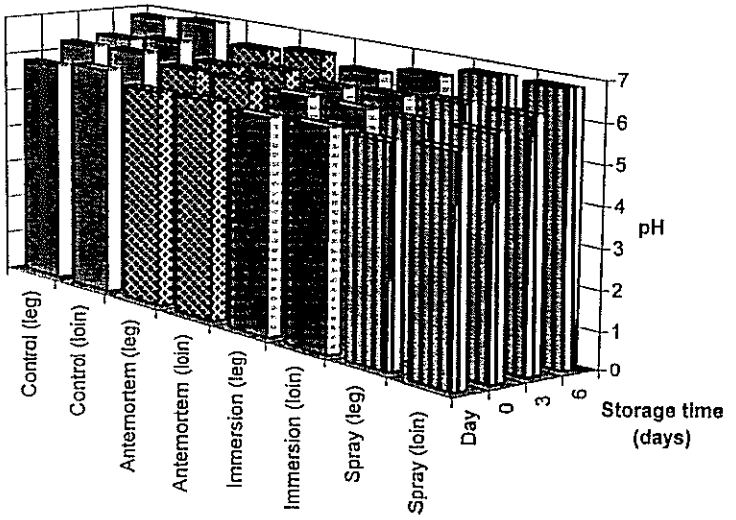


FIG. 2. pH LEVELS OF CONTROL AND ANTIBIOTIC APPLIED MEATS DURING STORAGE

Stop Test

The decay of antibiotic residues began earliest in the antemortem group, at 6 days of storage. This began at the 10th day for the immersion treatment, and at the 11th day for the spray application.

In conclusion, various CTC and OTC applications had no significant effect on chemical criteria of lamb except for pH levels and TBA values during refrigerated storage. TMAB counts indicated that "antemortem", "immersion" and "spray" methods extended the refrigerated shelf-life of lamb to 3, 4 and 5 days, respectively. These results are similar to those of Naik and Misra (1980). The stop tests showed that the antibiotics decayed and were eliminated from the meat during storage. Decay of TC antibiotics during storage may be an advantage from the point of public health. Since OTC and CTC residues were eliminated from the meat tissues and they could extend the shelf-life of lamb under refrigerated conditions up to 5 days, these applications, especially the spray and immersion treatments may be advisable to supply a preservative effect during refrigerated storage and extend the shelf-life of lamb.

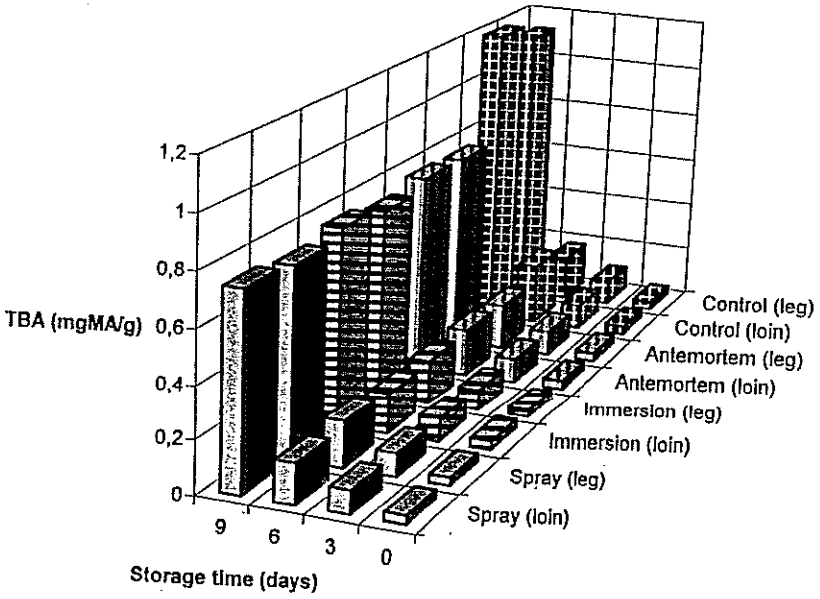


FIG. 3. TBA VALUES OF CONTROL AND ANTIBIOTIC APPLIED MEATS DURING STORAGE

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RESEARCH NOTE

QUALITY EVALUATION OF QUICK COOKING BASMATI RICE

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Accepted for Publication August 7, 1999

ABSTRACT

Basmati rice is valued for its flavor and long, bold grains. Traditionally this variety of rice demands a special cooking method of pre-soaking, boiling with an optimum amount of water and spreading for cooling. The technology to develop Quick Cooking Rice (QCR) hitherto used for nonscented rice has been extended to basmati rice, and the effect of processing on the cooking quality of basmati QCR was tested by sensory profiling, complemented by GC head-space volatiles for analysis of the basmati flavor released during rehydration. The performance of processed and unprocessed basmati rice is described here.

INTRODUCTION

Basmati is the leading aromatic rice variety in the world market, characterized by its pronounced pleasant and fragrant flavor. It is the preferred rice in East and South East Asia and Middle East countries for special cuisine (Paule and Powers 1989). India is one of the largest exporters of basmati rice, besides Pakistan, Indonesia and Malaysia (Hori *et al.* 1995). The quality of basmati rice is appreciated, because of its fluffy and individual grain character after cooking. Other sensory attributes of rice that consumers value in basmati rice include color, appearance, cooking characteristics and mouthfeel.

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Journal of Food Quality 23 (2000) 225–231. *All Rights Reserved.*
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The *Journal of Food Quality* (ISSN:0146-9428) is published (February, April, June, August, October and December) by Food & Nutrition Press, Inc.-Office of publications is 6527 Main Street, P.O. Box 374, Trumbull, Connecticut 06611 USA.

Periodicals postage paid at Bridgeport, CT 06602.

POSTMASTER: Send address changes to Food & Nutrition Press, Inc., 6527 Main Street, P.O. Box 374, Trumbull, Connecticut 06611 USA.

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Journal of Food Quality



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Journal of Food Quality

Edited by:
Terri D. Boylston, Ph.D.

Print ISSN: 0146-9428
Online ISSN: 1745-4557
Frequency: Bi-monthly
Current Volume: 32 / 2009
ISI Journal Citation Reports® Ranking: 2007: 78/103 (Food Science & Technology)
Impact Factor: 0.482

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